Graduate in Computer Science

Agile Governance Theory

by

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PhD Thesis

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Agile Governance Theory

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"Nothing is so practical as a good theory" (Lewin, 1945).

Reflection

"Wherever you are, whatever you're doing...
Take a moment to thank God for the gift of life.
Before to celebrate a victory, thank for the battle.
Before to reach an achievement, thank for the opportunity.
Before to attain an accomplishment, thank for the dreams.
Before to vibrate with joy, thank for the tears.
Because it is the battle that makes us strong, it is the opportunity that opens the paths, the dreams that nourish the faith, and tears that lead us to meet God."

"When you have faith, nothing is impossible...." Adapted from Matthew 17:20.

Abstract

***Context**: Competitiveness is the key to a sustainable development and it demands agility at the business and organizational levels, which in turn requires a flexible and customizable Information Technology (IT) environment, as well as an effective and responsive governance in order to deliver value faster, better, and cheaper to the business. **Objective**: This PhD thesis describes the research conducted to analyze and better understand this context, and which result is a theory to analyze and describe agile governance (AG). We assumed that once the agile governance phenomena are better understood, by means of the mapping of their constructs, mediators, moderators and disturbing factors, this achievement can help people and organizations reach better results in their application: reducing cost and time, increasing the quality and success rate of their practice. **Method**: We conducted a systematic literature review about the state of the art of agile governance, together with observation and interaction on professional groups based on social networks, and semi-structured interviews with representative agents of the phenomena in study. We have applied comparative and structuralist methods of procedures and have used some techniques of Grounded Theory to synthetize the collected data. We have also formatted the emerging theory by the Dubin's quantitative method of theory building for applied disciplines, and operationalized it for testing, by means of Structural Equation Modeling (SEM). **Results**: As a result, we could offer the phenomena characterization, a convergent definition for agile governance, six meta-principles, nine meta-values and a map of findings organized by topic and classified by relevance and convergence. We have developed a conceptual framework of the theory encompassing: its constructs, laws of interaction, boundaries and system states. Further, we have also operationalized the emerging theory: identifying its propositions, deriving empirical indicators from its constructs and establishing testable hypotheses to assess theory plausibility in eight theoretical scenarios, through an empirical study, by means of an explanatory survey with representative agents from phenomena under study. We had a response rate around 29.4% (obtained by the ratio of 281 responses out of 956 invitations), as well as an effective response rate around 12.3% (118 valid cases for statistical analysis, having a broad geographical coverage). The Confirmatory Factor Analysis (CFA) and SEM Analysis point out the plausibility of the theory components and hypotheses. **Conclusion**: The results present evidences of the theory plausibility, indicating that further studies are necessary to reach a trustworthy theory to analyze and describe the agile governance phenomena. At same time, lessons learned derived from this study, about the amplitude of the phenomena under study and the particularity of each subsample, suggest that the data collection instrument shall be tailored according to (i) each organizational context, (ii) suitable theoretical scenario, and (iii) chaos and order scale, in order to obtain more accurate data to analyze its: generalization, causality, explanation, and prediction. We expect that the emerging theory can provide some insights to understand agile governance phenomena and consequently help to achieve the necessary fluency in this area of knowledge in order to bring it to a new level, accelerating its development by scholars and practitioners. Eventually, we have made improvements and additions to the methodological approach for exploratory qualitative and quantitative studies.*

Keywords: *Information Systems. Agile Governance. IT Management. Project Management. Software Engineering*.

Resumo

***Contexto**: Competitividade é a chave para um desenvolvimento sustentável e isso demanda agilidade aos níveis organizacional e de negócio, o que por sua vez requer um flexível e customizável ambiente de Tecnologia da Informação (TI), bem como uma governança efetiva e responsiva com o objetivo de entregar valor mais rápido, melhor e mais barato ao negócio. **Objetivo**: Esta tese de doutorado descreve a pesquisa conduzida para analisar e melhor entender este contexto, e da qual resulta uma teoria para analisar e descrever governança ágil (GA). Assume-se que uma vez que os fenômenos de governança ágil são mais bem entendidos, por meio do mapeamento de suas construções, mediadores, moderadores e fatores perturbadores, esta realização pode ajudar pessoas e organizações a alcançar melhores resultados em sua aplicação: reduzindo custo e tempo, bem como aumentando a qualidade e a taxa de sucesso de sua prática. **Método**: Foi conduzida uma revisão sistemática da literatura sobre o estado da arte da governança ágil, conjuntamente com observação e interação com grupos profissionais baseados em redes sociais, e entrevistas semiestruturadas com agentes representativos dos fenômenos em estudo. Foram aplicados métodos comparativos e estruturalistas de procedimento e utilizadas algumas técnicas de Grounded Theory para sintetizar os dados coletados. A teoria emergente foi formatada pelo método quantitativo de Dubin de construção de teorias para disciplinas aplicadas, e, operacionalizada para teste, por meio de Modelagem de Equações Estruturais (SEM). **Resultados**: Como resultado, pôde-se oferecer a caracterização dos fenômenos, uma convergente definição de governança ágil, seis meta-princípios, nove meta-valores e um mapa de descobertas organizado por tópico e classificado por relevância e convergência. Foi desenvolvido um framework conceitual da teoria, abrangendo: seus construtos, leis de interação, fronteiras e estados de sistema. Além disso, a teoria emergente foi também operacionalizada: identificando suas proposições, derivando os indicadores empíricos de seus construtos, e estabelecendo hipóteses testáveis para acessar a plausibilidade da teoria através de um estudo empírico, por meio de um survey explanatório com agentes representativos dos fenômenos em estudo. Obteve-se uma taxa de resposta global de 29,4% (resultando de da participação de 281 respondentes de 956 convidados), bem como uma taxa de resposta efetiva de 12,3% (resultando em 118 casos válidos para análise estatística, possuindo uma ampla cobertura geográfica internacional). Os resultados da Análise Fatorial Confirmatória (CFA) e a Análise SEM apontaram para plausibilidade da teoria, seus componentes e hipóteses. **Conclusão**: Os resultados apresentaram evidências da plausibilidade da teoria, indicando que estudos adicionais são necessários para alcançar uma teoria confiável para analisar e descrever os fenômenos de governança ágil. Ao mesmo tempo, lições aprendidas derivadas desta pesquisa, sobre a amplitude dos fenômenos sobre estudo e da particularidade de cada grupo amostral, sugerem que o instrumento de coleta de dados deve ser adaptado de acordo com: (i) cada contexto organizacional, (ii) cenário teórico adequado, e (iii) escala de caos e ordem, procurando obter dados mais precisos para analisar sua: generalização, causalidade, explicação dos fenômenos e previsões. Espera-se que a teoria emergente possa prover algumas introspecções para entender os fenômenos de governança ágil, e consequentemente ajudar a alcançar a fluência necessária nesta área do conhecimento, a fim de trazê-la para um novo nível, acelerando o seu desenvolvimento por estudiosos e praticantes. Eventualmente, realizamos melhorias e adições às abordagens metodológicas para pesquisas exploratórias qualitativas e quantitativas.*

Palavras-chave: *Sistemas de Informação. Governança Ágil. Gerenciamento de TI. Gerenciamento de Projetos. Engenharia de Software*.

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Chapter

1

1. Introduction

This chapter presents some context about the addressed topic of study, the main issues that motivated this work, the research aims and how this thesis is organized.

1.1 Context

The global economy, generally referred as the macroeconomics or simply economy, is based on the study of the wide vision about the economies of all of the world's countries. As stated in *The Global Competitiveness Report 2011-2012* elaborated by World Economic Forum (2011), the world economy moved in 2011 around US$80.33 trillion in GDP (PPP[1]). In keeping with (IMF, 2012), at exchange rates, the economic output of the world is expected to expand by US$28.7 trillion from 2010 to 2017.

In addition, the New York Stock Exchange (NYSE), where the largest companies in the world are responsible for producing most of the wealth generated by those mentioned countries, negotiate their capital. In fact, NYSE is considered one of the largest stock exchange of the world, by the market capitalization of its listed companies that encompassed US$14.24 trillion as of December 2011, as well it had an average daily trading value approximately US$169 billion in 2013 (WFE, 2015). Likewise, according to Gartner Group (2014) the worldwide software revenue totaled $407.3 billion in 2013, meaning a 4.8 percent increase from 2012 revenue of $388.5 billion. Gartner points out the developed geographies as the primary growth drivers offsetting the relative sluggishness in emerging markets.

Undoubtedly, this is a very competitive context where the decisions should be made sometimes without the complete information required, as well as they should be communicated to the relevant sectors of the organization, which must have the capability to respond and redirect their actions to these changes in a wide and coordinated manner. Any mistake might cost millions of dollars or even can cost the business survival. Indeed, improving the competitiveness of governments and companies should result in significant economic outcomes.

It may seem strange for a Software Engineering practitioner, we are using the global economy as a backdrop to weave these considerations, but we are adopting this extreme scenario to give a higher contrast to the relevance of governance issues. Regardless of higher or lower impact,

[1] Purchasing power parity (IMF, 2012).

in any context, governance is a keystone that drives the organizational performance (Janssen and Shu, 2008 [S102][2]; Morck et al., 2005).

Consequently, to survive in any disputed market it is essential the development of organizational competitiveness, in either enterprises or governments. In like manner, in this kind of environment is not enough being competitive, but also "to look competitive". In a capitalist point of view, in any economy segment for turbulent markets, the slightest perceived lack of competitiveness of a company can devalue their stocks, leading to the financial overnight collapse(Rude, 2003).

The Business Dictionary (2013) defines *competitiveness* as: *"the ability of a firm or a nation to offer products and services that meet the quality standards of the local and world markets at prices that are competitive and provide adequate returns on the resources employed or consumed in producing them."*

Likewise, Michael E. Porter (1980), one of the world's leading authorities on competitive strategy and international competitiveness, points out that "competitiveness *is defined by the productivity with which a nation utilizes its human, capital and natural resources"*. He uses this definition of competitiveness to understand the drivers of sustainable economic prosperity at a given location (Porter, 1980).

Competitiveness seems related to make more, better and faster, with less resources (Janssen and Estevez, 2013) [S147]. At the same time, governance is closely related with the ability to steer (to guide, to govern) an organization, which may be a company, a government or a society (Bloom, 1991). In other words, governance is a key driver to "make things happen" on an organizational environment. Also, "to be" and "to look" is deeply related with transparency in decisions, actions and results of an organization, something closely related with governance. These thoughts would guide us to imply that the way to competitiveness pass by the application of a "good governance" (UNESCAP, 2013; Urban Governance, 1998; World Bank, 2006).

Under this context, the information and communication technologies (ICT or IT) are the link between the decision-making ability, the strategic willingness, and the competence to put

[2] The citations highlighted as [S*] are studies included in our systematic review cited at the stage 1 of the research framework depicted in Figure 2.1, and their complete references are available at APPENDIX I.2. References marked like this will be listed only in the mentioned Appendix to avoid duplication.

these tactics into practice concretely (Joshi et al., 2013; Quaadgras et al., 2011 [S161]). In this scenario, *IT governance*, through which *corporate governance*[3] is applied, has emerged as an option to the effective management and control of IT services in organizations (ITGI, 2001). Through the influence of factors related to market regulation, such as the Sarbanes-Oxley Act (Congress of the United States of America, 2002) and the Basel Accords (Bank for International Settlements, 2010), the use of governance is also motivated by other objectives, such as: i) reducing the costs of business unavailability; ii) assurance of business processes continuity; iii) IT investments payback guarantee; and, iv) increasing organizational competitiveness (Weill and Ross, 2004a).

Furthermore, the design and maintenance of the IT systems for enterprise agility can be a challenge when the products and services must be compliant with several regulatory aspects (often needing to be audited) (Wright, 2014). However, the establishment of the necessary management instruments and governance mechanism to fulfill this mission passes by the application of models and frameworks that many times have no guidance details of how to implement and deploy them (such as ITIL and COBIT, among others), affecting the organizational competitiveness (Gerke and Ridley, 2009; Mendel, 2004).

On the other hand, a good governance to be reached demands capabilities such as *flexibility*, *responsiveness* and *adaptability*, as well as an effective and *responsive* sense of coordination across multiple business units (Escrig-Tena et al., 2011 [S88]; Gong and Janssen, 2012 [S142]; Makhlouf, 2012 [S154]; UK National Audit Office, 2012). Actually, those mentioned capabilities belong to the *agility* paradigm in consonance with several authors, such as (Chen et al., 2008 [S86]; Li, 2010 [S59]; Matt, 2007 [S43]; Poligadu and Moloo, 2014; Sharifi et al., 1997 [S33]; Sun et al., 2005 [S28])

Moreover, Kruchten (2011) [S92] defines agility as: "*the ability of an organization to react to changes in its environment faster than the rate of these changes*". In fact, this definition uses the ultimate purpose or function of being agile for a business, unifying and standardizing agile and lean approaches as simply "agile", rather than defining agility by a labeled set of practices or by a set of properties defined in opposition to the agile manifesto approach (Beck et al., 2001). Due to this simplified and objective approach, this will be the definition of agility adopted for this work. We recognize that while ***agility*** is focused on reacting rapidly to changes,

[3] "It is the set of processes, policies, rules, laws and institutions that affecting the way as a corporation is directed, administered or controlled" (Cadbury, 1992)

lean is focused on combating the wastages. Although those approaches sometimes may seem confrontational if analyzed in its essence, we believe that the rational balance between those approaches can result in a unified "***agile***" approach that can achieve a better result than if they were applied separately, in consonance with (Wang et al., 2012) [S165].

Besides, a "good governance" requests particularly "organizational agility", which is stated by Thomsett (2013) as: *"the ability of an organization to respond quickly and effectively to unanticipated events in its environment".* As a result, agility became an important business aspect, and according to Luftman et al. (1993), **business agility** is: *"the ability to change the direction of the environment and respond efficiently and effectively to that change".* In consonance with this definition, we distilled the following *definition* to **business agility** to use on this study, as: *"the ability to deliver value[4] faster, better, and cheaper to the business"* (Luna et al., 2014b).

Agile governance has been proposed (Qumer, 2007 [S64]; Cheng et al., 2009 [S63]; Luna et al., 2010 [S60], 2013 [S150], 2014b) as the wide application of principles and values of Agile Software Development (Beck et al., 2001) to the conventional governance processes. Luna (2009) has developed a framework for agile governance, in order to implement and improve governance in organizations, called MAnGve. This framework is focused on the deployment process, as a catalyzer to accelerate the deployment of governance. The MAnGve framework is designed to mitigate the lack of practical focus found in conventional governance models (MAnGve.org, 2009). The MAnGve is a framework based on an agile life cycle, seeking to translate the principles, values and practices from Agile Software Development to IT governance paradigm. However, altogether the agile governance phenomena still remained unexplored in depth.

In the subsequent Sections, this chapter gives an overview of our motivation, the assumption of this thesis, the study aims, as well as we will present a guide on how to read this thesis in a pragmatical way.

[4] "An informal term that includes all forms of value that determine the health and well-being of the firm in the long run." (BD, 2013)

1.2 Motivation

Based on the evidences discussed on previous Section, a relevant issue is the understanding of the agile governance phenomena and the contexts in which they occur. Once the agile governance phenomena were better understood in their essence, and their constructs, mediators, moderators and disturbing factors were mapped, we should imply that these findings can help organizations to achieve better results in agile governance application: reducing cost and time, increasing the quality and success rates of their practice.

Taking into consideration that no systematic review of agile governance has previously been found, we conducted a *systematic literature review* about the state of the art of agile governance (SLR-AG) in order to better understand the agile governance phenomena, and published as (Luna et al., 2014b).

Our review confirms that agile governance has a wide spectrum of interest for executives from many business areas, professionals, researchers and practitioners by treating, in essence, aspects such as: organizational performance and competitiveness. Also, it can be verified by the categories and major groups that emerged from these review findings. The entire conclusions, discussions and implications for research and practice from the SLR-AG will be detailed in the Section 3.7.12.

In fact, when we started our doctoral research under this same context and motivation, we intended to propose a model for Agile Governance paradigm. However, after two years refining the knowledge available about this topic and conducting the aforementioned systematic review (SLR-AG), we realized two major issues: (1) **the paradox of the *emerging phenomenon*[5]**: "*If any system that can be a unit of analysis for a model definition is contained into a phenomenon, which the researcher does not know, neither understand (yet): how can the researcher characterize the boundary conditions to define the system that will be the reference to propose the model?*"; (2) **domain development level**: based on the findings from (Luna et al., 2014b) and in line with some authors below, we point out: (i) we consider precipitated and inconsistent proposing a model for agile governance in this stage of development, because the research design of this study has to adapt itself to the current state of theory and research,

[5] When we met this paradox in our work, we faced it not only as a specific paradox emerging from our research, but we deduced it as a broad paradox of Information Systems, addressing to the relationship between models, systems and phenomena in study. As we did not find any reference about similar paradox related to those aspects, we named it as a new one.

which is evidently nascent (Edmondson and McManus, 2007); (ii) as a result, the development level demands for exploratory qualitative studies, originally open-ended data that have to be interpreted for meaning (Edmondson and McManus, 2007); (iii) likewise, we are dealing with a nascent field of study where all set of knowledge should be organized, connected and systematized in some kind of conceptual framework or theory, then to serve as a basis for future work, such as: models, applications, etc. (Bordage, 2009); and, (iv) a *theory*[6] or a *conceptual framework*[7], for analysis and description, it is an instrument compatible with the stage of development of the phenomena in study, which can give better understanding about how the agile and governance capabilities can be combined and applied in a coordinated manner in order to achieve business agility (Gregor, 2006).

As a result of the SLR-AG, we found that the studies that handle over the adoption and introduction of agile methods on governance capabilities are still at an initial stage. Many of them were presented as a set of good intentions, but without a scientific rigor, which compromises their credibility and applicability. On the other hand, the big picture depicted by all of them do not give a unified view of ongoing practice, but offers a straightforward picture of experience and multiple fragmented findings (Luna et al., 2014b).

In line with these thoughts, we proposed "***agile governance***" as the *coordinated application* of **agile** (and **lean**) *capabilities*[8] with **governance** *capabilities* in order to improve ***business agility***, which we believe can result in significant economic outcomes for companies and governments (Luna et al., 2014b).

When we look at the application of agility on governance it may seem like antagonistic ideas (an *oxymoron*[9]) or counter intuitive, because governance denotes the idea of mechanisms, control, accountability and authority, while agility conveys the idea of informality, simplicity, experimentation, and for some observers (maybe) "almost anarchy". Nevertheless, if the goal of an enterprise is to achieve business agility, it cannot be reached without commitment from all sectors of the organization, which in turn cannot be achieved without governance. We will go further in Section 3.7.2 (see **Figure 3.5**).

[6] "A general principle, explanation of a phenomenon or abstract generalization that systematically explains the relationship among given phenomena, for purposes of explaining, predicting or controlling such phenomena."(Ahdellah, 1969)
[7] "Represent ways of thinking about a problem or ways of representing how complex things work the way that they do." (Bordage, 2009).
[8] "The power or ability to do something." (OED, 2013)
[9] "A figure of speech in which apparently contradictory terms appear in conjunction." (OED, 2013)

Grounded on these understandings, our judgment leads us to consider the exploration and comprehension of these phenomena as a higher priority of this domain, justified by the development stage of this field of study and by the philosophical paradox faced. As a result the proposition of a *theory* for agile governance seems an auspicious product for this study, meeting the claims from the SLR-AG findings and providing a theoretical approach that can help researchers and practitioners.

Gregor (2006) clearly advocates that the development of theory in Information Systems (IS) has significance for research and practice. In fact, developing theory is what academic researchers meant to do, as well as it sets them apart from practitioners and consultants. For instance, leading journals in Information Systems (IS) expect that published research articles will have a strong grounding in theory (EJIS, 2013; INFORMS, 2013; MISQ, 2013).

This seems to be an ancient issue, because according to (Lewin, 1945) there is the view that "*nothing is as practical as a good theory*". Gregor (2006) points out that theories are practical because they allow knowledge to be accumulated in a systematic manner and this accumulated knowledge enlightens professional practice.

An initial premise for this work is that different types of theory exist in Information Systems and that all can be valuable. However, the existence of a theory that addresses the **Agile Governance** issues was not found before or during the development of this study.

This work has a focus on organizations that need to operate (sense and respond) in turbulent and/or competitive environments, as well as that need to grow sustainably, reacting as a coordinated whole, attaining greater enterprise agility and supporting their overall strategy, in the context of IT Governance.

The preliminary findings indicate the originality of this research, because: (1) *we have not found any scientific or technical study about agile governance* that help to describe and analyze their phenomena; (2) *competitiveness* and *sustainable development* are concerns related to organizations survival and development, especially in environments where *change* is part of the business operations nature; and, (3) this issues becomes even more relevant when justified by the *development stage of this field of study*: clearly nascent and lacking in studies that can give direction and impetus to its development. Further, we really hope that this work can generate a valuable contribution to give a unified view of agile governance: research and practice.

1.3 Thesis assumptions

Considering that, as presented in the previous Sections:

I. Nowadays agile governance are a poorly explained phenomena (Luna et al., 2014b);
II. Currently, people apply agile governance serendipitously or facing many challenges (Luna et al., 2014b; Parcell and Holden, 2013 [S153]; Monizza et al., 2013 [S156]);
III. According to (Gregor, 2006), (Bordage, 2009) and (Edmondson and McManus, 2007), a theory or a conceptual framework is an instrument compatible with the stage of development of the phenomena in study, and a significant contribution, which can give a better understanding about them;
IV. Improving competitiveness of governments and companies through the improvement of their governance and management shall result in significant economic returns (Porter, 1980; Rude, 2003; WFE, 2015; World Economic Forum, 2011).

It is assumed that:

> *A theoretical approach to analyze and describe agile governance can help people and enterprises to achieve better results in their application: reducing cost and time, increasing the quality and success rate of their practice.*

1.4 Research goals

This study has a general objective whereby will be directed all the efforts. In consideration of achieving it, some specific objectives have to be progressively reached. The next Sections will describe each one of them.

1.4.1 General objective

Based on the assumptions presented in Section 1.3, the general objective of this study is to provide a better understanding of the agile governance phenomena, by seeking (i) to identify what are the elements that influence business performance, (ii) how those elements interact with each other, and (iii) how a ***theoretical approach*** to *analyze and describe agile governance* can help researchers and practitioners in order to increase the success rate of their practice, achieving organizational performance and business competitiveness. Specifically, we think this

general objective can be reached by the proposition of a ***theory*** for "*analysis and description*" (Gregor, 2006), which can be used to describe what agile governance is.

1.4.2 Specific objectives

The general objective can be depicted into the following specific objectives:

1. Advance in state of the art of agile governance, reaching a better understanding of the level of general development of this topic, by means of a set of methodological approaches:
    a. Systematic literature review (Dybå and Dingsøyr, 2008a; Kitchenham et al., 2007) to establish a starting point about the amplitude and depth of the phenomena under study;
    b. Interaction with representative agents of those phenomena, through:
        i. Observation and interaction on professional social networks, inspired in some techniques from Meta-ethnography (Noblit and Hare, 1988);
        ii. Semi-structured interviews (Barriball and While, 1994; Hove and Anda, 2005; Turney, 2009; Wood, 1997);
2. Frame the understanding achieved for the agile governance, by means of a theory to analyze and describe the agile governance phenomena, their constructs, mediators, moderators and disturbing factors (Corbin and Strauss, 1990; Dubin, 1978, 1976; Eisenhardt, 1989; Lynham, 2002a; Pandit, 1995), keeping the following characteristics in mind:
    a. A theory that can be instantiated by a lifecycle for implementation and improvement of sustainable business agility.
    b. A theory that can be instantiated for the following organizational contexts: teams, projects, business units, enterprise, or even in a multi-organizational setting.

3. Assess the plausibility of the emerging theory in Information Systems context, by means of the following approaches:

    a. By operationalizing it through Structural Equation Modeling (Marôco, 2014);

    b. By conducting a Explanatory Survey with representative agents of those phenomena, to evaluate and improve the structural aspects of the theory (Groves et al., 2013).

    c. By comparing to extant theory to further elaborate the proposed theory (Eisenhardt, 1989; Glaser and Holton, 2007).

1.5 Research questions

Rooted in the stated objectives, answering "*what is agile governance and how can we analyze and describe its phenomena?"* implies to be relevant to help people to *increasing the success rate of agile governance practice, which may lead to favor organizational sustainability and competitiveness*. From this "**core issue**" we can derive the following **major research question**, which should be answered to achieve the objectives of this research:

RQ1. *What is agile governance and how can we analyze and describe its phenomena?*

From this major research question, we can derive the following **minor research questions**, which when they are answered will help to address the major one, and consequently they will aid to reach the research objectives, depicted in previous Section:

RQ2. *What are the elements that can **be identified to** analyze and describe agile governance phenomena?*

RQ3. *How those elements interact with each other?*

RQ4. *Can those elements and their interactions be described as a system?*

RQ5. *Can that system be applied to make explanation and prediction?*

RQ6. *Can that system be conceptualized as a theory to analyze and describe agile governance phenomena?*

RQ7. *Can that theory be depicted in theoretical scenarios to analyze real-world contexts?*

RQ8. *Can that theory be operationalized and tested?*

RQ9. *How can the theory be used as an adaptive and reflexive reference to help executives and teams become more aware of their actuality, in order to address their overall business strategy, and find their own way toward maximizing delivery of business value?*

1.6 A theoretical approach for practical application

As expected results we have worked for the resultant theory can be used by organizational contexts (teams and organizations), allowing them to: (1) align whole of organizational context capability to the governance needs of the organization; (2) identify any factor which can have harmful effects on organizational context and that could be treated; (3) identify any gaps in competencies that could be eliminated, or competences that must be developed, to handle with those factors; (4) assist executives and teams to become aware about their actuality and address their overall business strategy, giving them an adaptive and reflexive reference to find their own way toward maximizing the delivery of business value.

1.7 Guide to this Thesis

In order to help the reader, we have developed **Figure 1.1** pointing out the Research framework that will be detailed in the Chapter 2, main research contributions, and where the reader will be able to find their respective developments, results and discussions. In short, this doctoral thesis is organized as follows:

1. **Chapter 1: Introduction**

   This chapter contextualized this study by reporting the major motivations to the development of this research, relating the aims of this inquiry, describing the topic in study and further characteristics, such as: motivations, assumptions, research questions, and finally, depicting the guide to read this thesis in a pragmatically manner.

2. **Chapter 2: Methodology**

   The aim of this chapter is to develop a detailed description of the study design, methodological framework, and also procedural approach adopted to conduct this

research, as follows: (i) characterizing the methodological approach upon the following aspects: objectives, technical procedure, nature of variables, method approach and methods of procedure; (ii) presenting the study design and identifying for each stage: data collection procedure for theoretical sampling, research goals, procedure and techniques, and main products; and finally, (iii) describing briefly each method and technique of this study.

3. **Chapter 3: Background and related work**

This Chapter's goal is to present the state of the art of agile governance domain, shedding light and better understanding on how agile governance is applied on organizational context, through analysis of some constructs[10], such as: its concept and application, as well as how it evolved over the time, shortcomings, evolution, and trends, among others. Those elements will be useful to the development of the theory proposed for this study.

4. **Chapter 4: Theory development**

This chapter will detail the resulting theory, after the execution of the research study design, consisting of: (i) presenting the conceptual development of the theory in terms of its conceptual framework, comprising: its constructs (units), laws of interaction, boundaries, systems states; (ii) describing theory research operation, reporting the development of theory's propositions, empirical indicators, hypotheses, and research agenda to testing the emerging theory; (iii) describing the application of theory building method and its results; (iv) describing the organizational context in which the theory operates; (v) analyzing the system created by the emerging theory, discussing its application, behavior, usefulness and consequences using the theoretical lens of Dubin (1978, 1976) and disciplined imagination of Weick (1989); (vi) proposing a set of guidelines and tools on how to put them into practice the emerging theory; and, (vii) suggesting motivation for theory use, and how the reader can adapt the emerging theory to his or her own organization.

5. **Chapter 5: Theory assessment**

[10] These refer to the components of the phenomena of interest (Gregor, 2006).

In this chapter will be reported the theory assessment procedures, comprising: (i) describing the empirical study designed to assess the plausibility of the theory; (ii) presenting the results of this empirical study; (iii) discussing the impact of these results upon the emerging theory, and their reflections in the theory refinement; and finally, (iv) presenting other theories in Information System area to compare and contrast with the proposed theory, also to examine what is similar, what is different, and why, in order to enhance the internal validity, generalizability, and theoretical level of the theory building.

6. **Chapter 6: Conclusion and perspectives**

Finally, in this chapter we will summarize the theory, as well as discuss how the proposed theory meets the thesis assumption and answers the research questions. We will also explain how the theory can impact the organizational environment. Eventually, we will summarizethe thesis' contribution, explain opportunities for further research, and address the traditional issues of threats to the validity and study limitations.

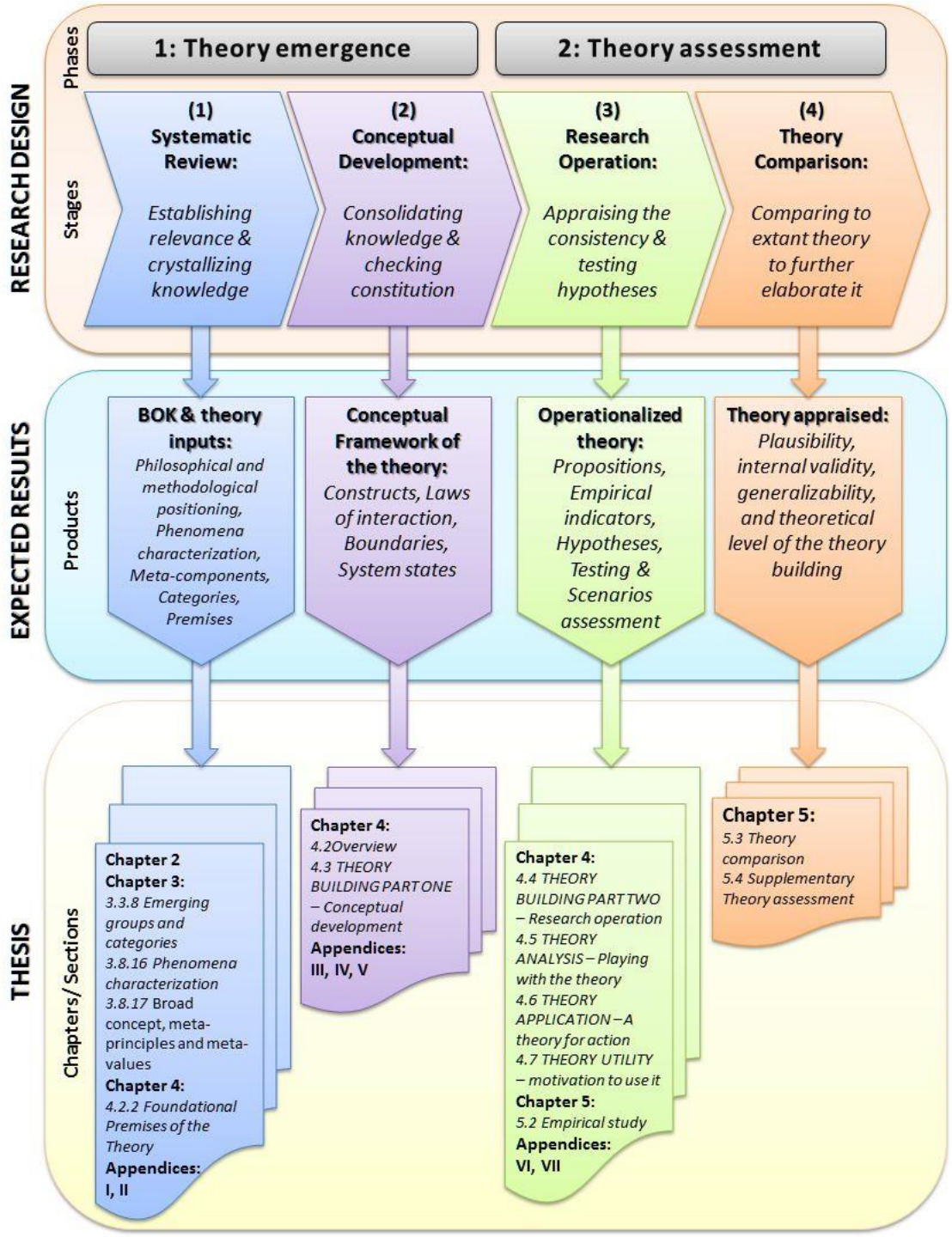

Figure 1.1 – Research framework: Research design *vs*. Expected results *vs.* Thesis. Inspired on: (Adolph, 2013; Aramayo, 2013; Dorairaj, 2013; Lynham, 2000; Monasor, 2014; Reinehr, 2008)

Chapter

2

2. Methodology

This chapter aims to describe the methodological framework, the study design, and the procedural approach adopted to conduct this research.

2.1 Scientific discovery

In a general approach, "knowledge" (from the Latin: *cognoscere*) is "*the act or fact of coming to know*", i.e., means to perceive, to understand, to realize. It is, at the same time, the *result* and the *process* of a cognitive edification (J. Li, 2007). Also, it is "to know" the essence contained in what is known (e.g., information), not only to understanding of the meaning, but it is, above all, “to know how to make use of it”, for the purpose for which it is intended.

Karl Popper (2002), one of the greatest philosophers of science of the 20th century, suggests that it is the task of the logic of scientific discovery, or the logic of knowledge, to give a logical analysis of this procedure; that is, to analyze the method of the empirical sciences. In fact, as cited in (Ichikawa and Steup, 2001), Plato defined knowledge as “justified true belief”, i.e., true because it is based on concrete facts, and justified because it was tested in some way.

All these thoughts, lead us to realize the research as the pursuit of knowledge and define the philosophical stance of this study as the statements of assumptions regarding what we believe comprises evidence and what we must to substantiate the evidence we present in this study as knowledge.

While **ontology** is the philosophical study of the nature of reality, as well as the basic characterization and classification (in categories) of being and their relations (Hofweber, 2004). In complement, **epistemology** is the study of knowledge and justified belief, which can be also defined as the relationship between the researcher and the reality, or how this reality is captured or known (Steup, 2014). Due to this, the researcher needs to state what he or she believes constitutes knowledge, and explain how he or she will obtain, develop or extend that knowledge. However, in order that knowledge becomes a scientific one, it must be tested against the real-world. The following Sections describe the research methodological design and how we execute it.

2.2 Study design

As reported by Creswell (2003), a researcher should make use of a framework to guide his or her project research since the identification of the epistemological stance that underpins the

researcher's philosophical stance, until the procedures for collecting and analyzing data. According to Myers (1997), the relevant items that should be considered in the research project are: (1) philosophical perspective, (2) methods, (3) techniques of data collection, and (4) methods of analysis and interpretation of data; similarly to those proposed by Creswell (2003).

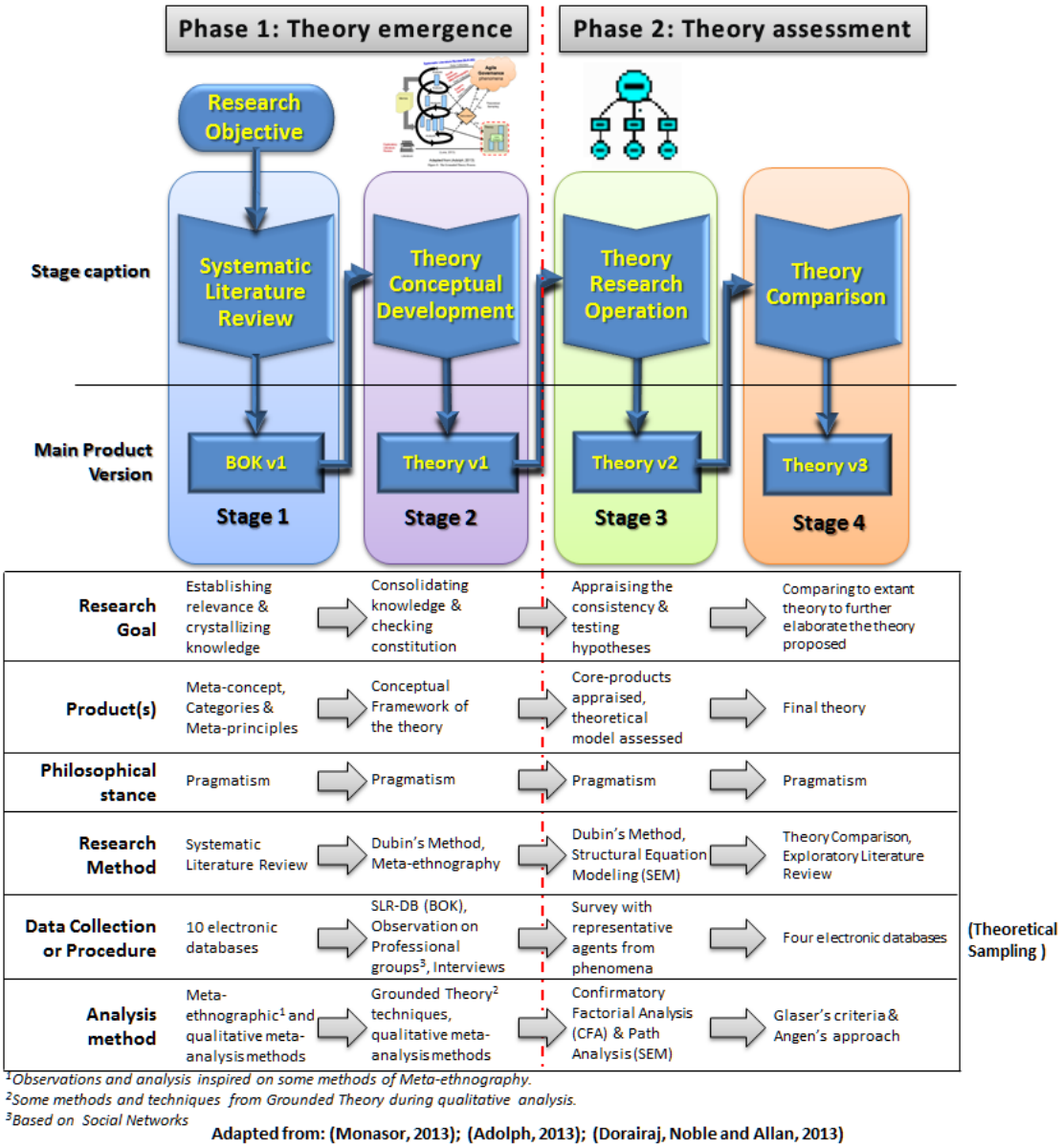

Figure 2.1 – Research framework. Inspired on: (Adolph, 2013; Aramayo, 2013; Dorairaj, 2013; Lynham, 2000; Monasor, 2014)

Using as reference the views of Myers (1997) and Creswell (2003), and inspired by some study designs applied by researchers with whom we have had contact over time (personally or through their work, in some cases: both), we have designed a research framework depicted in **Figure 2.1**, which treats the relevant aspects to be considered by this study. Actually, we can consider this research framework as a secondary contribution, for *theory building research*, once we could not find a research framework that mixes qualitative and quantitative

approaches for *theory building*, neither combines methods applied in this research, such as: systematic review, qualitative meta-analysis methods, Dubin's method, and Structured Equation Modeling.

Our research can be depicted on two major phases: (1) the *theory emergence*; (2) the *theory assessment*. Where, each phase comprises two stages. Follows a brief description of these stages:

1. At the **stage 1** we develop a Systematic Literature Review (Dybå and Dingsøyr, 2008a; Kitchenham et al., 2007) to investigate the state of the art of agile governance domain, establish the relevance of this work and frame this study, identifying the adequate approach for the following stages of this research. At this stage Bibliometrics and Scientometrics (Weingart, 2005) were important to establish the relevance of the selected studies in the literature for the review process and also to help in the synthesis procedures. As a result, we generated a set of findings that crystalize a representative sampling from the phenomenon under study, which we called Body of Knowledge (BOK). From this BOK emerged during the synthesis process, using qualitative meta-analysis methods (Noblit and Hare, 1988), a new convergent meta-concept for agile governance, a mapping of findings organized in four major thematic groups and 16 categories, as well as six meta-principles and some directions for research and practice. These directions for research and practice not only confirmed the alleged importance of this research, as well as gave us the guidance for the next steps of this work, allowing to define the final study product and consolidating the study design to achieve the research aims.
2. At **stage 2** we carried out conceptual development of the theory, following the initial four steps that comprise part one of Dubin's methodology for theory building research (Dubin, 1978). At that time, we identified and characterized the core-components of the emerging conceptual theoretical framework: units (constructs), laws of interaction, boundaries and system states. To complement data from stage 1, we add two new theoretical sampling sources: (1) observation and interaction on professional groups based on social networks, composed by researchers and practitioners in governance, management and agile methods (Marcus, 1995; Murthy, 2008; Scott, 1994; Wolfe, 1997); and, (2) semi-structured interviews with representative agents from the phenomena in study. In order to analyze and synthetize findings from those sampling,

e.g., emerging relations between the categories already identified in the previous stage, and the new categories and connections that can emerge during this stage, we adopted some techniques from Grounded Theory described by (Corbin and Strauss, 1990; Eisenhardt, 1989; Pandit, 1995) and qualitative meta-analysis methods described by Noblit and Hare (1988), among other complementary approaches, such as (Barnett-Page and Thomas, 2009; Britten et al., 2002; Stall-Meadows and Hyle, 2010).

3. In **stage 3** we have conducted four remaining steps of the part two of Dubin's methodology in order to enable the theory's operationalization (Dubin, 1978), producing: propositions, empirical indicators, and hypotheses that were tested to confirm or refute theory's plausibility. In consideration to perform the eighth and final step of Dubin's method, we have designed an empirical study to assess the theory plausibility, by means of an Explanatory Survey (Groves et al., 2013). This survey was carried out with representative agents of the agile governance phenomena, to test hypotheses from eight theoretical scenarios, derived from emerging theory, as well as assess other intrinsic properties, such as: generalization, causality, explanation, and prediction. We have applied Structural Equation Modeling (SEM) and Confirmatory Factor Analysis (CFA) (Hooper et al., 2008; Marôco, 2014; Weston, 2006) to operationalize the theory, and consequently the empirical study design.
4. Finally, in **stage 4** we have conducted an Exploratory Literature Review (Schuetzenmeister, 2010) to identify other theories in Information Systems (IS) area, after the theory had emerged and stabilized, and pull in extant theory to compare and contrast with the proposed theory (Glaser and Holton, 2007). Also, we did it to examine what is similar, what is different, and why, in order to enhances the internal validity, generalizability, and theoretical level of the theory building (Eisenhardt, 1989). At the same time, (1) we have applied the Glaser's criteria (Glaser, 1992) to evaluate the theory's *credibility*[11], and (2) Angen's approach (Angen, 2000) to conduct a validation from the *ethical* and *substantive*[12] perspectives, as well as (3) we have assessed the emerging theory under the criticism lens of Sutton and Staw (1995).

Based on the research framework depicted in Figure 2.1 we can also frame and classify the study under some dimension, such as depicted in Table 2.1.

[11] Glaser (1992) suggests credibility of a Grounded Theory can be evaluated through four criteria: fit, work, relevance and modifiability.
[12] A substantive approach to validation indicates researchers need to document the chain of interpretations in order for others to judge the trustworthiness of the meanings arrived at in the end (Angen, 2000).

Table 2.1 – Classification of Methodological approach. Source: Own elaboration.

Methodological Approach	Description and References
Philosophical stance	*Pragmatic* (Cherryholmes, 1992; Creswell, 2003; James, 1995)
Objective	*Exploratory* (Creswell, 2012, 2003; Marconi and Lakatos, 2003)
Technical procedure	*Exploratory Literature Review* (Schuetzenmeister, 2010); *Systematic Literature Review* (Dybå and Dingsøyr, 2008a; Kitchenham et al., 2007); *Bibliometrics and Scientometrics* (Weingart, 2005); *Phenomenology* (Creswell, 2012); *Dubin's method for theory building research* (Dubin, 1978, 1976; Lynham, 2002a); *Grounded Theory* (Corbin and Strauss, 1990; Eisenhardt, 1989; Pandit, 1995); *Meta-ethnographic and qualitative Meta-analysis* (Noblit and Hare, 1988); *Structural Equation Modeling (SEM) and Confirmatory Factor Analysis (CFA)* (Hooper et al., 2008; Marôco, 2014; Weston, 2006); *Survey inquiry* (Groves et al., 2013); *Angen's theory assessment approach* (Angen, 2000); and, *Theory comparison* (Eisenhardt, 1989; Glaser and Holton, 2007).
Nature of variables	*Mixed: Qualitative and Quantitative* (Creswell, 2012, 2003)
Method approach	*Mixed: Inductive* (Jebreen, 2012) and *Hypothetical-deductive* (Dubin, 1978; Marôco, 2014)
Methods of procedure	*Comparative and Structuralist* (Gauch Jr, 2003; Gower, 2002)

This type of research can be classified as **multi-method** or **mixed** (Creswell, 2003; Freitas et al., 2000) therefore applies in combination (1) *systematic literature review*, (2) *observation on professional groups based on social networks*, and (3) *semi-structured interviews* with emphasis on qualitative aspects; as well as (4) a cross-sectional research *explanatory survey* with quantitative approach.

We will use the research framework depicted in **Figure 2.1** to anchor every relevant consideration about the methodological approach and related decision in the following subsections. Whereas, we will describe briefly how each one of those approaches were adopted by this work. In order to help the reader to understand the integration among each stage of the research framework depicted in **Figure 2.1**, as well as the combined application of every technique and method, we have elaborated the **Figure 2.2** that depicts detailed version of the research framework.

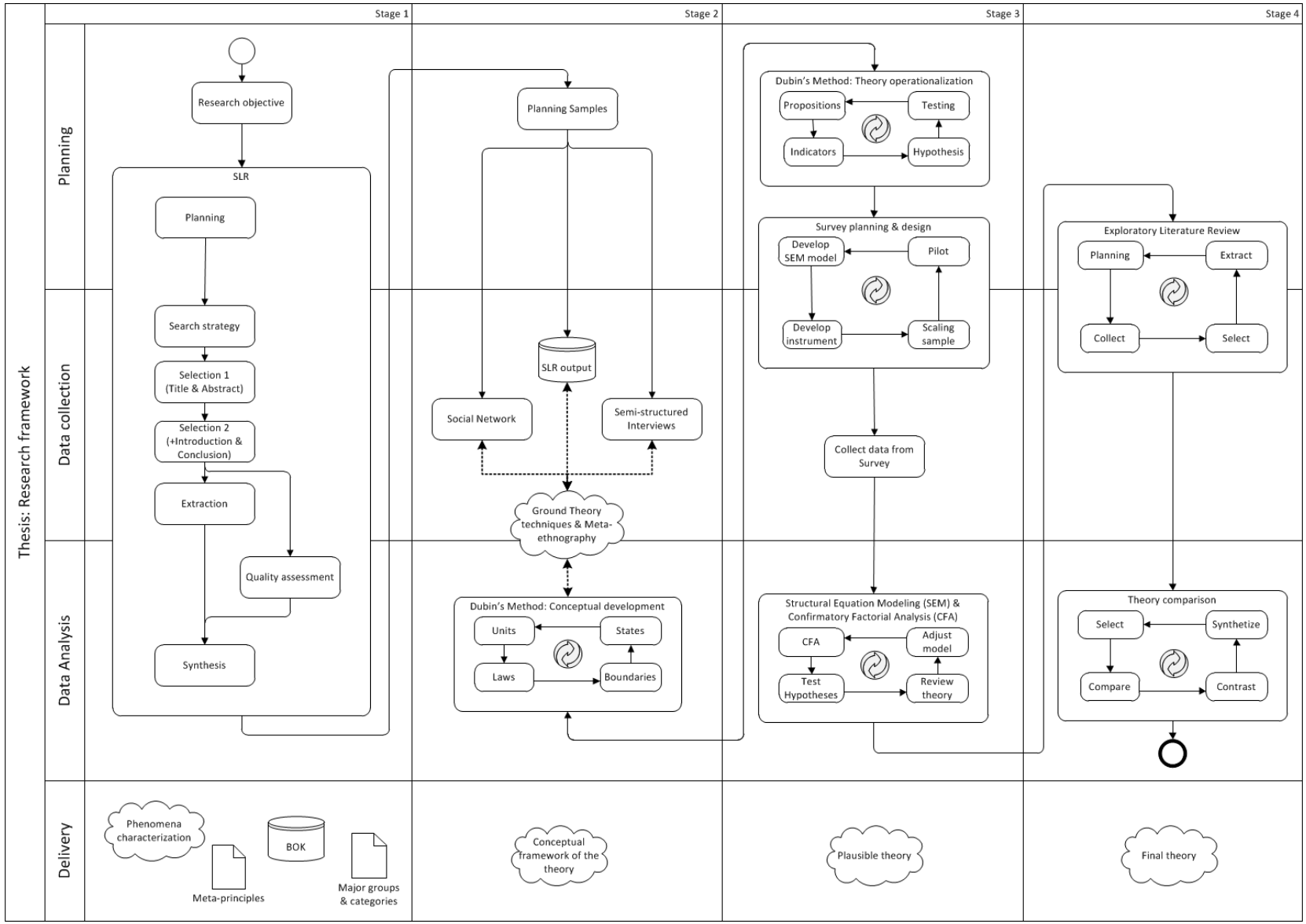

Figure 2.2 – Detailed research framework. Source: Own elaboration.

2.2.1 Philosophical stance

Myers (1997) points out that any research (whether quantitative or qualitative) is based on some underlying assumptions about what constitutes "valid" research and which research methods are appropriate. In order to conduct and/or evaluate qualitative research, it is therefore important to know what these (sometimes hidden) assumptions are.

Guba and Lincoln (1994) suggest four underlying "paradigms" for qualitative research: *positivism*, *post-positivism*, *critical theory*, and *constructivism*. In turn, Chua (1986), followed by Orlikowski and Baroudi (1991) as well as by Myers (1997), suggests three categories, based on the underlying research epistemology: *positivist*, *interpretive* and *critical*. In addition, Creswell (2003) presents four schools of thought about knowledge claims: *post-positivism*, *constructivism*, *advocacy participatory*, and *pragmatism*.

Our position is that theories should be useful, and, whenever possible, practical and applicable in essence! In keeping with Sjøberg et al. (2008) we adopt the view of the philosophical school of ***pragmatism***, considering both specific beliefs and methods of inquiry in general should be judged primarily by their consequences, by their usefulness in achieving human goals. According to this philosophical perspective, the meaning of an idea corresponds to the set of its practical implications.

According to Creswell (2003), *pragmatism* derives from the work of the philosopher and mathematician Charles Sanders Peirce; the philosopher and psychologist William James; the philosopher, sociologist and psychologist George Herbert Mead; and the philosopher, psychologist, and educational reformer John Dewey, at the "The Metaphysical Club", US in the 1870s (Cherryholmes, 1992). In fact, James (1995) argues that theories are instruments, not answers to enigmas, because answers allow us to rest quiet while instruments are useful only when used for practical purposes. At the same time, James (1995) argues that a theory can only be proven by evidence their practical effects, thus having similarities with empiricism. Despite pragmatism has received some criticism, even from (Russell, 1992), because according to him, it is usually more difficult to find out whether a belief is useful to find out whether it is true. Dewey countered criticism by arguing that the goal of pragmatism is not to reach a final goal

super sanctified. Rather, the goal is just to take consideration of what is best for humanity, reflecting on the changes needed to adapt to the dynamic context of our societies (Waal, 2007).

As stated in Creswell (2003) and supported by Cherryholmes (1992), pragmatism provides a basis for the following knowledge claims:

1. Pragmatism is not committed to any one system of philosophy and reality. This applies to **mixed methods research** in those assumptions when they engage in their research.
2. Individual researchers have a **freedom of choice**. They are "free" to choose the methods, techniques, and procedures of research that best meet their needs and purposes.
3. Pragmatists **do not see the world as an absolute unity**. In a similar way, mixed methods researchers look to many approaches to collecting and analyzing data rather than subscribing to only one way (e.g. quantitative or qualitative).
4. **Truth is what works at the time**: it is not based in a strict dualism between the mind and reality completely independent of the mind. Thus, in mixed methods research, investigators use both quantitative and qualitative data because they work to provide the best understanding of a research problem.
5. Pragmatist **researchers look to the "what" and "how" to research based on its intended consequences** - where they want to go with it. Mixed methods researchers need to establish a purpose for their "mixing," a rational for the reasons why quantitative and qualitative data need to be mixed in the first place.
6. Pragmatists **agree that research always occurs in social, historical, political, and other contexts**. In this way, mixed methods studies may include a postmodern turn, a theoretical lens that is reflexive of social justice and political aims.
7. Pragmatists believe that **we need to stop asking questions about reality and the laws of nature**: "they would simply like to change the subject".

We can still say that the *agile* and *lean philosophies* have close relationship with the *pragmatic philosophical perspective*, based on nature of its objective approach and their focus on action to reach the useful and rapid results. Thus, for the mixed methods researcher, pragmatism opens the door to multiple methods, different worldviews, and different assumptions, as well as to different forms of data collection and analysis in the mixed methods study.

2.2.1.1 Personal reflections: beliefs and motivations

Conforming to Creswell (2007), the researcher's philosophical informed view about reality (what knowledge is, and ways to gain knowledge) is a guiding perspective about the nature of change and human behavior and thus is the very foundation for research. Indeed, the researcher, and his or her audience, needs to be aware of his values in the form of the experiences. This section seeks to explicit, in short, the researcher's personal beliefs and motivations, in order to create a clear picture to the interpretation of the research results, in consideration of reduce biases, and reactions to the data that may shape his interpretation of the data. This is a good practice for scientific research, and it has special recommendation for theory building research, as highlighted by Adolph (2013).

Without going into an autobiography, I can be described as an experienced software developer, systems analyst, project manager, IT manager and IT consultant who has participated in the design and management of large software projects, organizational consulting projects, IT infrastructure projects since starting in the industry in 1995, sometimes participating as entrepreneur, public agent (working for government), at other times as freelancer. These projects included the development of software for transport and logistic, health care, e-business, education, and scientific tools; beneficing customers and citizens in Brazil, Europe and Africa.

Several of my personal friends are members or sympathizers of the agile and lean practices. I have a very strong belief that social dynamics are the dominant determinant of team productivity. I consider myself to be a practitioner more than an academic, and part of my motivation to conduct this research is that I personally believe that there is a significant gap between the IT governance research agenda and the practice of governance in industry and government.

At this point of our rationale, it is important to contextualize that we have been working on this domain at least in the past seven years. In 2009, I have proposed as a result of my *master degree dissertation*, an agile framework called MAnGve, as an alternative to implement and improve governance processes and service management on an agile lifecycle (Luna, 2009). In addition, we had opportunity to apply the MAnGve in the context of the Brazilian government,

reaching good results rapidly and consistently (after only two *tides*[13], along eight months): the involved team had been capable to implemented three governance processes and one service management function. At the same time, the team evolved from an operation based on "firefighting" to a maturity stage, where they are able to express their initiatives in terms of service management.

Throughout this period, since publishing of the MAnGve until nowadays, we had also opportunity to interact with scholars and practitioners interested in agile governance research and practice, as well as, in 2011, we have *publish a book* about agile governance (Luna, 2011a). However, altogether we realized that the agile governance phenomena still remained unexplored in depth.

As a consequence, in order to address this scientific open agenda, we have organized (and leading) a Research Cell focused on Agile Governance (AGC) from Project Research Group[14] (GP2) at Federal University of Pernambuco (UFPE). GP2 is comprised by researchers and students from Graduate Program of the Computer Centre (CIn) at UFPE, and coordinated by Prof. Dr. Hermano Perrelli de Moura. Moreover, we have proposed an inquiry agenda, organized according to the research framework view depicted in **Figure 2.3**, for the development of two PhD theses, and a MSc dissertation in agile governance theme, in order to establish a solid foundation for future research about this topic.

Figure 2.3 – Agile Governance Cell research framework. Legend: [*PhD candidates]. Source: (Luna, 2014).

As a consequence, over the last two years we have conducted a *systematic review* (as depicted in stage 1 of the Figure 2.1), which results will be described in the Chapter 3, to investigate the

[13] Complete lifecycle of the framework, timebox (Luna, 2011a).
[14] GP2 website: http://gp2.cin.ufpe.br/

state of the art of this domain and providing innovative knowledge for development of these researches depicted in **Figure 2.3**.

In this meantime, I had opportunity to develop a PhD Sandwich year period, under the supervision of Prof. Dr. Philippe Kruchten at Department of Electrical and Computer Engineering (ECE), The University of British Columbia (UBC), Vancouver, Canada. Hence, during that period I had opportunity to expand my *own vision and awareness* about the topic under study: (1) interacting with many scholars and practitioners, (2) attending some international conferences, and (3) "building some bridges", i.e., establishing affective and intellectual bonds, around the world.

As a consequence of these experiences, a set of knowledge intuitions, discoveries and insights about this topic were accumulated, condensed and crystallized by means of an *inductive* approach (Jebreen, 2012), supported by procedures *comparative* and *structuralist* (Gauch Jr, 2003). Even because, a doctorate process is as much about the *formation of a researcher*, as well as the *production of significant and original contributions* to the related field of study. In other words, the transformations undergone by the researcher during this process are as relevant as the results of the work done.

If on one hand, these previous experiences condensed on the own personality, experience, and character of the researcher can be seen as an important component of the research process, as well as they should be made an explicit part of the analysis (Strauss and Corbin, 1998). On the other hand, this approach must be adopted carefully on these preexistent concepts to do not "*violate the notion of theoretical emergence*", avoiding that preconceived notions of what is likely to be observed in the phenomena in study, which may reflect on what will "be seen" about the intended categories and overlooked more emergent ones (Suddaby, 2006).

At the same time, the balanced and rationalized combination (1) of the reported experiences, and (2) of the cited methodological warnings, were the guiding thread of the research approach. This approach has directed the way on how: (i) we have looked at the data; (ii) we have identified and analyzed the findings; and, (iii) we have synthesized the contributions. Indeed, the personal reflections about researcher beliefs and motivations become fairly relevant feature in the process that led to the completion of this research.

2.2.2 Methods overview

Qualitative research is an inquiry method whose aim is to attain an in-depth understanding of human behavior and the reasons that govern such behavior (Denzin and Lincoln, 2005). It allows researchers to examine certain phenomena, develop insights, and report those insights. It involves discovering and understanding causes within a context. In qualitative research, the phenomena can be interpreted in a variety of ways, as it entails an interpretative evaluation (Creswell, 2007).

Quantitative research is an inquiry method that is concerned with quantifying a relationship or comparing two or more groups with the aim of attaining an in-depth understanding of human behavior and the reasons that govern such behavior (Lynham, 2002a). Quantitative data is usually collected using controlled experiments, and is typically represented by numbers, depending on the application of the measurements, thus allowing comparisons to be made and statistical analysis to be carried out (Creswell, 2003; Marôco, 2014). Data collection in quantitative research can be conducted in many different ways (in which numeric data can be accessed), including case studies or surveys, and uses induction and deduction to search for aggregate patterns in empirical observations (Mark and Caputi Peter, 2001).

Mixed methods combine **qualitative** and **quantitative** research approach elements (e.g., the use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the broad purposes of breadth and depth of understanding and corroboration. If on one hand, one of the major advantages of using mixed methods research is that it allows researchers to view problems from multiple perspectives, thus enhancing and enriching the meaning of a singular perspective Creswell (2003). On the other hand, one of the common challenges when using mixed methods involves reaching agreements as to the research process in which mixing can occur. This also lead to the difficulty of defining effective strategies for integration at different stages of the research (Johnson et al., 2007). In order to overcome this challenge, we have developed the research framework depicted in **Figure 2.1**, as well as its detailed version portrayed in **Figure 2.2**, as an attempt to define a successful integration design between these two approaches.

In consonance with our philosophical pragmatic stance (Cherryholmes, 1992; Creswell, 2003), as well as the current state of theory and research in the agile governance domain, the design

of our research demands for an exploratory studies that have to be interpreted for meaning (Edmondson and McManus, 2007). This is also coherent with the finality of propose a theoretical approach.

Table 2.2 – Methods or techniques, purpose and references. Source: Own elaboration.

Method or Technique	Purpose	Reference
Systematic literature review (SLR)	At stage 1, to investigate the state of the art of agile governance domain, establish the relevance of this work and frame this study, identifying the adequate approach for the following stages of this research. Also, to confirm the estimated importance of this research, allowing to define the final study product and to consolidate the study design to achieve the research aims.	(Dybå and Dingsøyr, 2008a; Kitchenham et al., 2007)
Qualitative meta-analysis methods	At stage 1 and 2, to synthesize the data extracted from the studies, even whether: Body of Knowledge (BOK) derived from SLR, Observation on professional groups based on Social Networks, and Semi-structured interviews.	(Barnett-Page and Thomas, 2009; Britten et al., 2002; Noblit and Hare, 1988; Stall-Meadows and Hyle, 2010)
Some techniques from Grounded Theory (GT):	At stage 1 and 2, to collect, analyze and synthesize the data extracted from the different sources, of which we mention: Theoretical sampling; Coding and categorization of data (open, selective, intermediate, axial, advanced and theoretical coding); Constant Comparative Analysis (CCA); Theoretical Sensitivity; Writing memos; Theoretical integration.	(Corbin and Strauss, 2008, 1990; Eisenhardt, 1989; Pandit, 1995)
Dubin's methodology for theory building research	At stage 2 and 3, to shape, to structure, and to establish appearance (aesthetics), as well as to condense the substance distilled from stages 1 and 2 (data collection and analysis), which might be considered as the essence (raw material), into an emerging theory, by means of a quantitative theory-building methodology.	(Dubin, 1978, 1976; Lynham, 2002a)
Structural Equation Modeling (SEM) and Confirmatory Factor Analysis (CFA)	At stage 3, to test the hypotheses of the models derived from theoretical scenarios depicted by the emerging theory (the assumptions of the constructs and their behavior, including: their relations and mediation) derived from emerging theory, crystallized at stage 2 and stage 3.	(Hooper et al., 2008; Marôco, 2014; Weston, 2006)
Exploratory Literature Review	At stage 4, to identify other theories in Information Systems area, after the theory had emerged and stabilized.	(Randolph, 2009; Schuetzenmeister, 2010)
Theory comparison	At stage 4, to pull in extant theory to compare and contrast with the proposed theory, also to examine what is similar, what is different, and why, in order to enhances the internal validity, generalizability, and theoretical level of the theory building.	(Angen, 2000; Eisenhardt, 1989; Glaser and Holton, 2007)

Considering the factors and concerns we have just exposed, we decided to apply a mix of methods depicted in **Figure 2.1**, including approaches compounded with other methods, techniques and procedures to complement and reduce the likelihood of bias of this study.

Therefore, at the **stages 1, 2** and **4** of the *research framework* depicted in **Figure 2.1**, the approach is predominantly **qualitative**. On the other hand, after the theory emerge it is necessary developing and implementing a plan of research to test and thereby confirm the trustworthiness of the theory, or at least its plausibility. Hence, at the **stage 3** of the research framework the approach is mostly **quantitative**.

However, when using mixed methods, researchers need to establish a purpose for their "mixing," a rational for the reasons why quantitative and qualitative data need to be mixed in the first place. We did this as depicted in the Table 2.2.

The following subsections will describe briefly each method, procedure and technique, as well as other related issues to the methodological approach employed in this work.

2.2.3 Tools overview

In different stages of this research, we have used distinct tools for specific purposes. **Table 2.3** depicts the main tools used during this research.

Table 2.3 – Tools, purpose and references. Source: Own Elaboration.

Tool	Purpose	Reference
ATLAS.ti	For qualitative data analysis	(ATLAS.ti, 2015)
Bizagi Modeler	For Business Process Modeling	http://www.bizagi.com/
CMap Tools	For concept maps, ontologies and diagrams elaboration	http://cmap.ihmc.us/
Express Scribe Transcription Software	For interview audio transcription	http://www.nch.com.au/scribe/
IBM® SPSS® Amos 20.0	For Structural Equation Modeling (SEM) and Confirmatory Factor Analysis (CFA)	(Arbuckle, 2011; Blunch, 2012; Marôco, 2014)
IBM® SPSS® Statistics 20.0	For quantitative data analysis, including Exploratory Factor Analysis (EFA)	(Blunch, 2012; Griffith, 2010; IBM, 2015)
IPligence	Bulk IP address location, for Survey respondent location	http://www.ipligence.com/iplocation#results
Mendeley	For reference, citations and bibliography management	http://www.mendeley.com
MS-Access	For data storage and development of some software applications in order to help data manipulation	http://office.microsoft.com
MS-Excel	For quantitative data analysis	http://office.microsoft.com
MS-PowerPoint	For elaboration of diagrams, figures and presentations	http://office.microsoft.com
MS-Visio Draw	For diagrams and figures elaboration	http://office.microsoft.com
MS-Word	For thesis elaboration and editing	http://office.microsoft.com
StarUML	For UML diagrams elaboration	http://staruml.io/
SurveyMonkey	For collect data to Explanatory Survey	http://www.surveymonkey.net
XMind	For mind maps, diagrams and figures elaboration	https://www.xmind.net/

2.3 Theoretical perspective

This section presents underlying ideas relevant to theory to preface the subsequent discussion of theory in Information Systems. It is necessary to express these ideas to show the underlying philosophical positions on which the thesis relies. The approach adopted is to give an outline of the perspectives considered and to highlight those differences in thought that are intimately connected with different approaches to theory, as well as some important commonalities. In turn, we will discuss about the nature of the main product of this work: a theory.

Indeed, differences in views of theory depend to some degree on philosophical and disciplinary orientations, yet there are also commonalities. This thesis draws upon writings from the philosophy of the applied sciences, the social sciences, from the pragmatism tradition, and from the sciences of the artificial, all of which are relevant to Information Systems (Gregor, 2009).

In general, philosophers of science writing in the tradition of the physical or natural sciences are likely to see theory as providing explanations and predictions and as being testable. For example, Popper (2005) held that theorizing, in part, involves the specification of universal statements in a form that enables them to be tested against observations of what occurs in the real world. Popper described theory as follows (p. 37):

> *"Scientific theories are universal statements. Like all linguistic representations they are systems of signs or symbols. Theories are nets cast to catch what we call 'the world'; to rationalize, to explain and to master it. We endeavor to make the mesh even finer and finer."*

According to Gregor (2006), apart from this qualification, none of the theory types necessitate a specific ontological or epistemological position (for example, an pragmatism stance, or naïve realism, or value-free enquiry, or quantitative methods).

In a similar vein, it has been argued in other disciplines that different approaches to theory should be recognized and combined. In the field of management, DiMaggio (1995) suggests that many of the best theories are hybrids, combining the best qualities of covering-law, enlightenment, and process approaches.

It is important to highlight that in social and behavioral sciences, with which Empirical Software Engineering shares many methodological issues, deeming a theory as false based on its predictions, is rarely feasible (Weick, 1989).

2.3.1 What is a theory?

In fact, the dictionary definitions depict that the word theory can take on many meanings, including "a mental view" or "contemplation," a "conception or mental scheme of something to be done, or the method of doing it; a systematic statement of rules or principles to be followed," a "system of ideas or statements held as an explanation or account of a group of facts or phenomena; a hypothesis that has been confirmed or established by observation or experiment, and is propounded or accepted as accounting for the known facts; statements of what are held to be the general laws, principles, or causes of something known or observed," a "mere hypothesis, speculation, conjecture" (OED, 2013).

Hence, the word *theory* will be used here rather broadly to encompass what might be termed elsewhere conjectures, models, frameworks, or body of knowledge. Knowledge in this paradigm takes on a different perspective.

> *"**Knowledge** consists of those constructions about which there is a relative consensus (or at least some movement towards consensus) among those competent (and in the case of more arcane material, trusted) to interpret the substance of the construction. Multiple 'knowledges' can coexist when equally competent (or trusted) interpreters disagree."* (Guba and Lincoln, 1994) *p. 113.*

For this reason, the word *knowledge* when used in this thesis does not refer to knowledge of specific events or objects, but means body of knowledge, or theoretical knowledge.

In turn, Nagel (1979) distinguishes theories from **experimental laws**, believing that theories are more comprehensive, whereas an experimental law can be a single statement.

> *"A **theory** is a system of interrelated statements, possibly containing abstract theoretical terms that cannot be translated into empirical measures. The theory might also include statements about causality, with varying concepts of causality, including teleological causation, so that the theory provides causal explanations".*

According to Gregor (2006), apart from explanations, theories **can also aim at predictions**, which allow the theory both **to be tested** and **to be used to guide action**. Prediction goes hand in hand with testing.

Dubin (1978) refers to two specific situations as the **precision paradox** and the **power paradox** respectively: (1) that is, it is possible to achieve precise predictions without necessarily having understanding of the reasons why outcomes occur; (2) moreover, it is possible to have models that are powerful in contributing to understand processes without providing, at the same time, precision in prediction.

In fact, the distinction between the goals of explanation and prediction is central to the differentiation among types of theory. A theory is an artifact in that it is something that would not exist in the real world without human intervention.

2.3.2 Theory in Information System (IS)

According to Gregor (2006) and Sjøberg et al. (2008), an argument is made that an appropriate taxonomy for IS depends on classifying theories with respect to the degree and manner in which they address *four central goals* of theory: analysis, explanation, prediction and prescription.

1. **Analysis and description:** The theory provides a description of the phenomena of interest, analysis of relationships among those constructs, the degree of generalizability in constructs and relationships and the boundaries within which relationships, and observations hold.
2. **Explanation**: The theory provides an explanation of how, why, and when things happened, relying on varying views of causality and methods for argumentation. This explanation will usually be intended to promote greater understanding or insights by others into the phenomena of interest.
3. **Prediction**: The theory states what will happen in the future if certain preconditions hold. The degree of certainty in the prediction is expected to be only approximate or probabilistic in IS.
4. **Prescription**: A special case of prediction exists where the theory provides a description of the method or structure or both for the construction of an artifact (similar to a

recipe). The provision of the recipe implies that the recipe, if acted upon, will cause an artifact of a certain type to come into being.

In addition, *five different types of IS theory* distinguished by (Gregor, 2009, 2006; Sjøberg et al., 2008) are labeled: (1) theory for analyzing, (2) theory for explaining, (3) theory for predicting, (4) theory for explaining and predicting (EP theory), and (5) theory for design and action.

I. **Analysis**: Says what is. The theory does not extend beyond analysis and description. No causal relationships among phenomena are specified and no predictions are made. Including taxonomies, classifications and ontologies in consonance with (Gruber, 1993).
II. **Explanation**: Says what is, how, why, when, and where. The theory provides explanations but does not aim to predict with any precision. There are no testable propositions.
III. **Prediction**: Says what is and what will be. The theory provides predictions and has testable propositions but does not have well-developed justificatory causal explanations.
IV. **Explanation and prediction (EP):** Says what is, how, why, when, where, and what will be. Provides predictions and it has both testable propositions and causal explanations.
V. **Design and action**: Says how to do something. The theory gives explicit prescriptions (e.g., methods, techniques, principles of form and function) for constructing an artifact.

2.3.3 What kind of Theory?

According to Gregor (2006), the **Theory for Analyzing** or **Analytic Theory** is the most basic type of theory and necessary for the development of all of the other types of theory. Clear definition of constructs is needed in all theory formulation. In fact, Gregor (2006) suggests that certainly, the components of **Theory for Analyzing** or **Analytic Theory** are necessary before theory of other types can be expressed clearly. Analytic theories analyze "what is" as opposed to explaining causality or attempting predictive generalizations. These theories are the most basic type of theory. They describe or classify specific dimensions or characteristics of individuals, groups, situations, or events by summarizing the commonalities found in discrete observations. They state "what is."

Moreover, as cited in Gregor (2006), Fawcett and Downs (1986) advocate that "*descriptive theories are needed when nothing or very little is known about the phenomenon in question*"**,** that is coherent with the current state of theory and research on agile governance, which is evidently nascent (Edmondson and McManus, 2007)**.** However, what constitutes a contribution to knowledge with theory of this type? In fact, as pointed out by Miles and Huberman (1994) theory that describes and analyses is valuable, when little is known about some phenomena, in consonance with Fawcett and Downs (1986). Any evidence gathered would be expected to have credibility. Descriptions presented should correspond as far as possible to "what is".

Grounded Theory (GT) has arisen as one of the best-known method to produce theories (Glaser, 2002). Gregor (2006) highlights that some examples of Grounded Theory can also be examples of **type I theory** (theory for analysis), where the Grounded Theory method gives rise to a description of categories of interest. In addition, Suddaby (2006) points out that where researchers have an interesting phenomenon without explanation and from which they seek to "discover theory from data" is the context when Grounded Theory is most appropriate. The exact situation experienced by this study. Indeed, this approach has been widely employed for the development of recent theories in IS, such as: (Adolph et al., 2012), (Dorairaj et al., 2011).

Considering the wide and multidisciplinary nature of this domain pointed out by our systematic review (developed at stage 1 of the research framework depicted in Figure 2.1), we believe that a *theory for analysis and description* (Gregor, 2006), should be a legitimate classification for the emerging theory from this work, which can be used to describe what agile governance is, as well as help to interpret and understand how agile and governance capabilities can be applied in order to achieve business agility.

2.3.4 Considerations about theory development

In keeping with Gregor (2009), theorizing relies upon the methods judged suitable for knowledge development. Scientific theory is often equated with the use of scientific methods, adopted to obtain it. In very general terms, science is supposed to employ methods that compare "*hypotheses with experiments and observation to weed out the wheat from the chaff*".

This vision is grounded on "hypothetico-deductive method" (H-D), one of the most generally accepted view of the scientific process. As reported by Gregor (2009), current forms of the

hypothetico-deductive method owe much to the logician Charles Pierce in the 19th century, who combined the H-D method with symbolic logic and recognized three primary modes of reasoning that are at play in scientific enquiry: *abductive*, *deductive* and *inductive* reasoning

There are also differing views of theory building in other areas of the human and applied sciences. Merton (1967) writing about sociological theory, advocated the development of theory on an adequate base of "*antecedent empirical enquiry*". Bourgeois (1979) provides a description whereby theory of the middle range is generated in a non-linear process with seven steps including theory generation by induction from an empirical base.

According to Weick (1989), the process of theory construction in organizational studies is portrayed as imagination disciplined by evolutionary processes analogous to artificial selection. He argues that interest is a substitute for validation during theory construction, *middle range theories*[15] are a necessity if the process is to be kept manageable, and representations such as metaphors are inevitable, given the complexity of the subject matter. In other words, he saw theory construction as "disciplined imagination".

In order to avoid methodological weaknesses that can jeopardize the theory building, we have proposed a multi-method research (Creswell, 2003; Freitas et al., 2000), to build a *middle range theory for analysis and description of the agile governance phenomena*. We have integrated both qualitative and quantitative approaches in a set of studies, through the research framework depicted in **Figure 2.1**, in which the procedures will be described in the following Sections.

2.4 Data Collection

2.4.1 Systematic Literature Review: a collaborative approach (SLR-AG)

The work developed on this systematic review adopted as a methodological reference a combination from the following approaches: (Dybå and Dingsøyr, 2008b; Dybå et al., 2007; Kitchenham et al., 2010, 2007). This Section describes the resulting approach. A systematic review process comprises three phases: (1) planning the review, (2) conducting the review, and

[15] *Middle range theory* is a theory with limited scope, that explains a specific set of phenomena, as opposed to a *grand theory* that seeks to explain phenomena at a societal level (Merton, 1967).

(3) reporting the review. The Figure 2.4 depicts the entire Systematic Review Process adopted in this research.

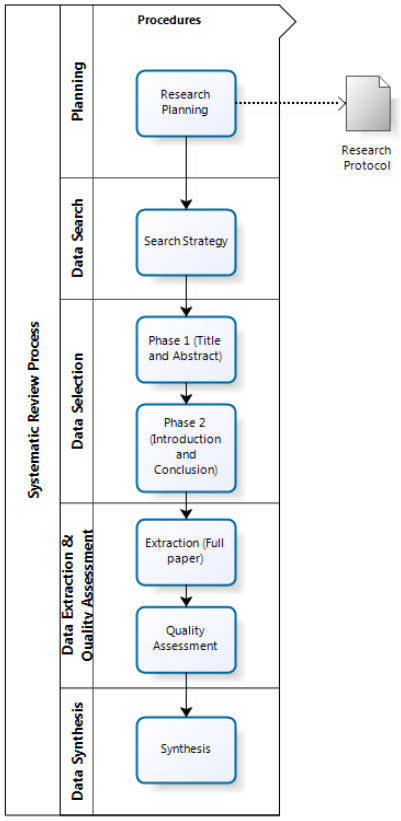

Figure 2.4 – Systematic Review overview process. Source: (Luna et al., 2014c).

The major activity in planning the review is designing a review protocol. A research protocol for the systematic review was developed by complying the guidelines, policies and procedures of the Kitchenham's Guidelines (Kitchenham et al., 2007) and complemented by the Dybå's approach (Dybå and Dingsøyr, 2008b), as well as by the consultation with specialists on the topic and methods. Succinctly, our protocol establishes: i) the research questions; ii) search strategy; iii) inclusion, exclusion and quality criteria; iv) data extraction; and, v) methods of synthesis. The protocol is available in full version at the URL of the following reference (Luna et al., 2014c).

As mentioned in Section 2.2.1.1 this systematic review was organized in order to prepare an overview of the topic area in which we are working, providing evidences for consolidate and extend the initial results, as well as providing innovative knowledge for the development of PhD theses and MSc dissertations in agile governance theme, and also establish a solid foundation for future research about the topic.

In order to enabling this purpose in a coordinated manner we established the main research question as a broad inquiry in consideration of the goal of provide an overview of a research area, and identify the quantity and type of research and results available within it. This main research question directed the team efforts to understand the amplitude and the relationships among the many contexts where the agile governance phenomena manifest themselves. In complement, we derived from the main question a set of specific questions addressing particular aspects that are of interest for each graduate research from the research cell. The Figure 2.5 depicts those relationships.

The main research question that motivates this study is:

RQ1. What is the state of the art of Agile Governance in the world?

In other words: How has behaved the domain of agile governance in the world? In which domains the agile governance phenomena manifest themselves? What are the works and initiatives in this domain? We are also interested to know how this domain is applied in the organizations and how this impacts people's lives and businesses.

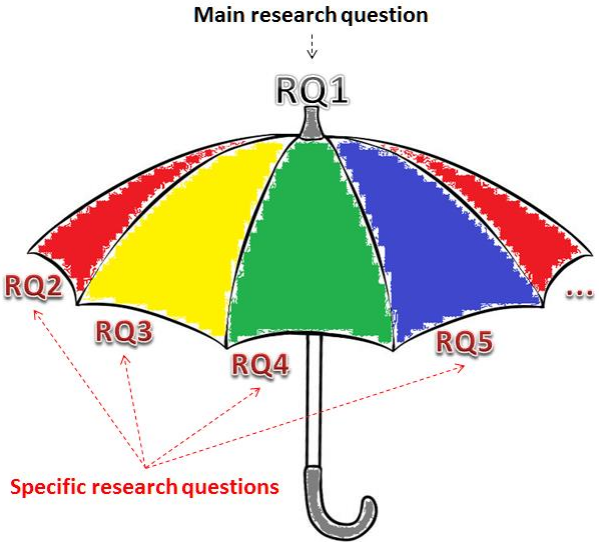

Figure 2.5 – Relationship among Research Questions. Source: (Luna et al., 2014c).

In order to answer the previous main question, as well as to map evidences that will help team members to investigate specific aspects of the agile governance phenomena, which are relevant to their own graduate researches, the following specific research questions were defined, as follows:

RQ2. How the domain of agile governance has been evolved?

RQ3. Which are the concepts, practices, principles and values on this domain?

RQ4. Who are the authors and publication channels that have published about this theme?

RQ5. How agile governance is applied in the organizations and which are the perspectives?

RQ6. How agile governance has impacted people's lives and organizations' business?

RQ7. Which are the benefits and motivations for adopting agile governance?

RQ8. Which are the problems, challenges and critical success factors faced on the adoption of agile governance?

RQ9. Which are the support mechanisms applied for the implementation of agile governance?

RQ10. Which are the support mechanisms for assessing the capability, maturity or evolution stage of organizations regarding agile governance?

RQ11. Which are the mechanisms for auditing the processes of organizations regarding agile governance?

RQ12. Which are the indicators and metrics applied for monitoring the progress of agile governance?

RQ13. Which are the initiatives of agile governance implemented in multi-organizational environments?

RQ14. Which are the management models, frameworks or architectures used in the organizations under the context of agile governance?

Thus, the combined effort of the research team would be contributing to the overview of the research area (common interest), while everyone was contributing to identify, evaluate and interpret available relevant evidence related to particular interest of each graduate research. This symbiotic working configuration brought inspiration, motivation and sense of teamwork, generating excellent results in sharing learned lessons and mutual cooperation.

In other words, the research team carried out a mapping of the state of art of agile governance, while perform the extraction and codification for specific aspects related with the phenomena in study. Those specific aspects were represented by the constructs of each specific research question. Accordingly, while the search strategy, citation management, retrieval, inclusion decisions, quality assessment, data extraction and data codification was performed by the research team, the synthesis of findings was carried out in each specific research question by those researcher interested in each issue.

In fact, the systematic method was carried out jointly until the **stage 4** of Figure 2.6, getting the synthesis of findings (stage 5) to be conducted for each question by the researcher who had specific interest on every question related with his or her graduate research. Regardless, many times the more experienced researchers helped the less experienced ones at the **stage 5** for specific research questions, also.

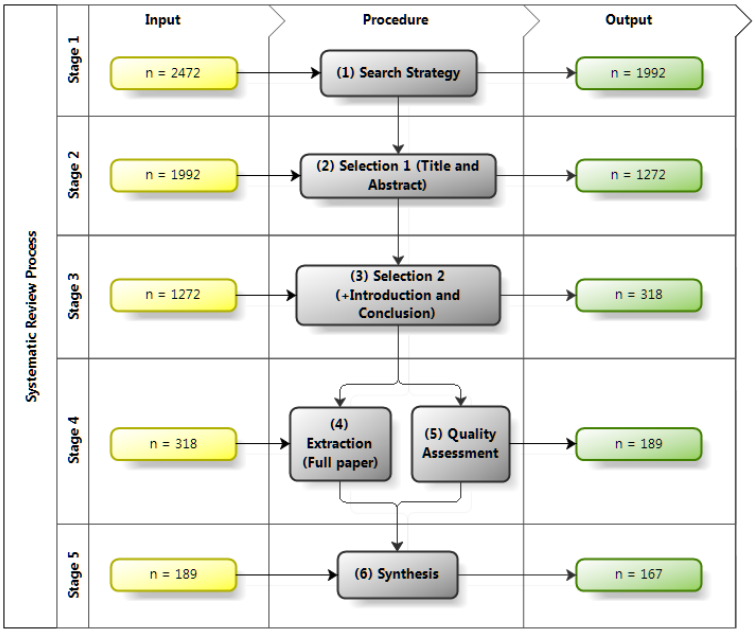

Figure 2.6 – Systematic Review detailed process. Source: **(Luna et al., 2014b)**.

Due this systematic review evaluates, synthesizes, and presents concrete evidences on agile governance to date, and give an overview of topics researched, characterizing what is agile governance (see Sections 3.7.2 and 3.7.10).

In short, our systematic review (Luna et al., 2014b) has investigated how the domain of agile governance has evolved, as well as it derived implications for research and practice. The review scope has covered up to and including 2013. Our search strategy identified 1992 studies in 10 databases, of which 167 had the potential to answer our research questions. We organized the studies into four major groups: software engineering, enterprise, manufacturing and multidisciplinary; classifying them into 16 emerging categories. As a result, the review provides a convergent definition for agile governance, six meta-principles, and a map of findings organized by topic and classified by relevance and convergence. The found evidence lead us to believe that agile governance is a relatively new, wide and multidisciplinary area focused on organizational performance and competitiveness that needs to be more intensively studied. Also, we have made improvements and additions to the methodological approach for systematic reviews and qualitative studies.

Detailed information about the procedure adopted by this review, such as: i) the research questions; ii) search strategy; iii) inclusion, exclusion and quality criteria; iv) data extraction; and, v) methods of synthesis; is available in the review overview at the APPENDIX I.

Specific details about the review, methodological approach employed and its findings are organized in specific appendices, as follows: **APPENDIX I.1** -SLR: Sistematic Literature Review Protocol, **APPENDIX I.2** -SLR: Studies Included, **APPENDIX I.3** -SLR: Quality Assessment Form, **APPENDIX I.4** -SLR: Data Extraction Form, **APPENDIX I.5** -SLR: Overview of the Studies, **APPENDIX I.6** -SLR: Overview of Quality Assessment, **APPENDIX I.7** -SLR: Studies: Contributions, Focus, Sampling and Geography (Q1), **APPENDIX I.8** -SLR: Emerging Categories, Studies and Constructs (Q1), **APPENDIX II** -SLR: Emerging findings.

2.4.2 Observing Professional Groups based on Social Networks (SNME)

Based on the findings of the our systematic review, and starting to have a better understanding about the nature of the agile governance phenomena, we have selected professional groups based on social networks, related to the multidisciplinarity and amplitude of the phenomena under study. Those groups were also based on LinkedIn[16], i.e., the world's largest professional network with 300 million members in over 200 countries and territories around the globe.

The selection criteria adopted to select these professional groups were:

I. **Adherence:** if the group has relationship with the phenomena under study.

II. **Focus:** if the group has focus on industry or scientific issues related those phenomena.

III. **Composition:** if the group is comprised by scholars and practitioners with experience on governance and/or agile methods.

Many other details related to this study is depicted in the short version of the protocol available at **APPENDIX III.1**. We have started analyzing 37 groups, and gradually based on assessment of those criteria against the groups behavior, we have discarded some of them and carrying out the observation and interaction with 12 professional groups. These groups are depicted in **Table III.2** at **APPENDIX III**.

Our approach was organized on two stages: (1) **passive stage**: when we just observe members and their interactions, looking for posts and discussions related to the topic under study; (2) **active stage**: when we become provocative, creating discussion topics related to the

[16] Website: https://www.linkedin.com

phenomena and interacting with group members. **Figure III.1** and **Figure III.2** at **APPENDIX III** depict, respectively, a sample of data collection for each of these stages.

In fact, change from one stage to another in each group was due to the theoretical saturation. In other words, when we realize that, after a waiting time (two or three weeks), "anything new" was happening related to the issues that we had the interest of observe, we passed the active stage of observation.

We have gathered the discussions generating a PDF file (for every topic), at the end of the discussion (when the topic was "cold"). Further, we have added those files to the repository of our research, on ATLAS.ti for subsequent qualitative analysis, as described in Section 2.5.

From those 12 groups the most active ones were: NG03, NG06, NG07 and NG08. The observation and interaction processes on those groups were not concentrated or intensified in a specific time period, but it has happened piecemeal over the years of 2013 and 2014.

Ou approach as inspired on the meta-ethnographic and qualitative meta-analysis methods proposed by Noblit and Hare (1988). After the theoretical saturation, we have identified and extracted 190 quotes directly related to core layer of the nomological network (see Section 4.3.1.1.2) concerning to theory construct validity, from a total of 397 extracted quotes.

2.4.3 Semi-structured interviews (SSI)

In addition to initiating the observations of Professional Groups based on Social Networks, we also conducted a serie of semi-structured interviews with representative agents from agile governance phenomena based on the same sample profile (see **APPENDIX IV.1** or **Table 5.4**) defined to the Survey detailed on Chapter 5.

The purpose of these interviews was to discuss some relevant aspects related to agile governance phenomena, using a semi-structured script derived from the findings already achieved. We were specifically interested in understanding the factors that influence individuals, team performance and how it is perceived by the organizational context and its interactions with the external environment.

In order to reach this aim, we have invited 15 subjects among scholars and practitioners that match with the subject profile depicted in **Table 5.4**. As a consequence, we carried out ten

semi-structured interviews. **Table 2.4** lists the profile of the individuals who participated in the study interviews. Further detail about sample characterization is available in **APPENDIX IV.2**.

Table 2.4 – Interview Subject Description. Source: Own elaboration.

Subject	Main Job Position	Professional experience	Education	Organizational context	Chaos & Order	Duration
IT01	CEO	More than 20 years	Graduated	Multi-organizational	4	01:20
IT02	Professor	From 6 to 10 years	MSc	Enterprise	9	01:15
IT03	Professor	From 6 to 10 years	MSc	Project	7	01:04
IT04	Project Manager	From 11 to 15 years	MSc	Teamwork	6	01:25
IT05	CEO	From 16 to 20 years	PhD	Project	5	01:57
IT06	Consultant	From 16 to 20 years	PhD	Multi-organizational	4	01:34
IT07	Public Agent	From 11 to 15 years	MSc	Teamwork	5	01:10
IT08	Consultant	From 16 to 20 years	MSc	Multi-organizational	4	01:39
IT09	CEO	More than 20 years	PhD	Project	6	01:15
IT10	CEO	More than 20 years	MBA	Enterprise	6	01:32

All interviews, started with the questions, "*What do you understand for agility?*" followed by "*What do you understand for governance?*", and "*Does agile governance make sense for you?*", as well as "*How it is part of your life?*". Subsequent interview questions were guided by the subjects' answers to this question. We also, contextualize each interview by "organizational context" and a "self assessment about a scale from chaos to order" for this context.

APPENDIX IV.1 depicts the interview protocol. On average, we spent approximately one hour formally interviewing each subject. Interviews were digitally recorded and then transcribed. We have hired a professional service for transcript the audio from interviews. The interviews transcripts were added to the repository of our research, on ATLAS.ti for subsequent qualitative analysis, as described in Section 2.5. **APPENDIX IV.3** is a sample of a coded interview transcript, in order to illustrate the procedure. After each interview we spent, approximately, more 2.5 hours for each recorded audio hour, analyzing data gathered, before start the data analysis.

The interviews were not concentrated or intensified in a specific time period, but they have happened piecemeal over October, 2014 and December, 2014.

Ou approach as inspired on the semi-structured interview methods proposed by (Barriball and While, 1994; Canada Government, 2014; Hove and Anda, 2005; Turney, 2009). After the theoretical saturation, we have identified and extracted 497 quotes directly related to core

layer of the nomological network (see Section 4.3.1.1.2) concerning to theory construct validity, from a total of 1099 extracted quotes during this process.

2.4.4 Explanatory Survey (ES)

The procedures adopted to carry out the Explanatory Survey at the Stage 3 of the research framework are detailed in Section 5.2.

2.5 Data Analysis and Synthesis

2.5.1 Qualitative data analysis

The data gathered from those sources (whether papers from systematic review, discussions from social professional networks, or audio transcripts from semi-structured interviews) were stored in an electronic repository using a tool for qualitative analysis (ATLAS.ti, 2015).

The data samples were stored in different moments during this research into the same repository, insofar as they were collected. Every collected data has been turned into text. In case of the audios from semi-structured interviews, we have hired a professional transcription service to achieve this aim. During the qualitative data analysis, essentially, every piece of text (each line, sentence, paragraph, etc.) was read in search of the answer to the repeated question "What is this about? What is being referenced here?"

When the data could be construed for meaning, through the analysis of the emerging data patterns, in the context where they were collected, they were extracted as quotes. Actually, each "quote" is, in fact, an "indicator" of some event or behavior relevant for the research purpose, which may be indicated by a text fragment, such as: a word, a sentence, paragraph, or even a set of paragraphs.

In the glossary of Grounded Theory, "*indicators represent minute data fragments, because of the frequent admonitions about line-by-line comparison and examples provided*", particularly in (Strauss and Corbin, 1998) writing. However, this explanation would sounds a little bit confuse. So, to avoid any misunderstanding about it, ***indicators*** *represent data patterns that emerge from brute data*, and ***quotes*** *are the textual evidences whereby we capture such patterns*. In

practice, they are almost the same thing, having the prior, an abstract essence (idea), and the later a concrete nature (text). In other words, *we have identified the indicators*, but *we have gathered the quotes*. Further, from here we will use the both terms as synonyms. In order to simplify the understanding of the concepts used during the data analysis and data synthesis we elaborate a model in Unified Modeling Language (UML) (Booch et al., 1998), depicted in **Figure 2.7.**

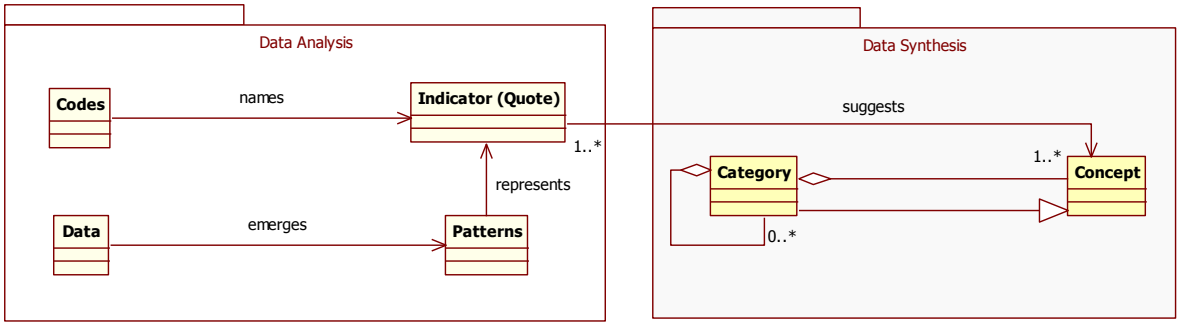

Figure 2.7 – UML model for the essential concepts related to data analysis and synthesis. **Source**: Inspired on (Adolph, 2013).

During the extraction procedure we carried out a coding procedure for each quote, labeling the meaning that every quote had to help understand the phenomena addressed by the ongoing inquiry. In other words, by means of the coding procedure, we have tried to identified, naming, categorizing and describing phenomena found in the text. In short, "codes" are "labels" that help to identify (suggest) relevant "concepts" related to the phenomena in study.

The codes arising from data were constantly compared to codes previously gathered. From the constant comparisons of the codes (Corbin and Strauss, 2008), we grouped codes into "categories" that represent factors affecting agile governance and the outcomes of value delivery.

According to Glaser (2008) the constant comparative method is useful to identify and try to capture the full scope of emerging concepts: "*The pattern is named by constantly trying to fit words to it to best capture its imageric meaning. This constant fitting leads to a best fit name of a pattern, to wit a category or a property of a category. Validity is achieved, after much fitting of words, when the chosen one best represents the pattern*" (p. 4).

Along the open coding procedure (and whenever a new code was found), we have attempted make links among codes identified, with the aim of recognize causal relationships, trying to fit things into a basic frame of generic relationships. This procedure is known as axial coding and it

aims relate codes (concepts and categories) to each other, via a combination of inductive and deductive thinking (Corbin and Strauss, 2008, 1990; Eisenhardt, 1989; Pandit, 1995). **Figure 2.8** depicts an example of the category building process, open and axial coding.

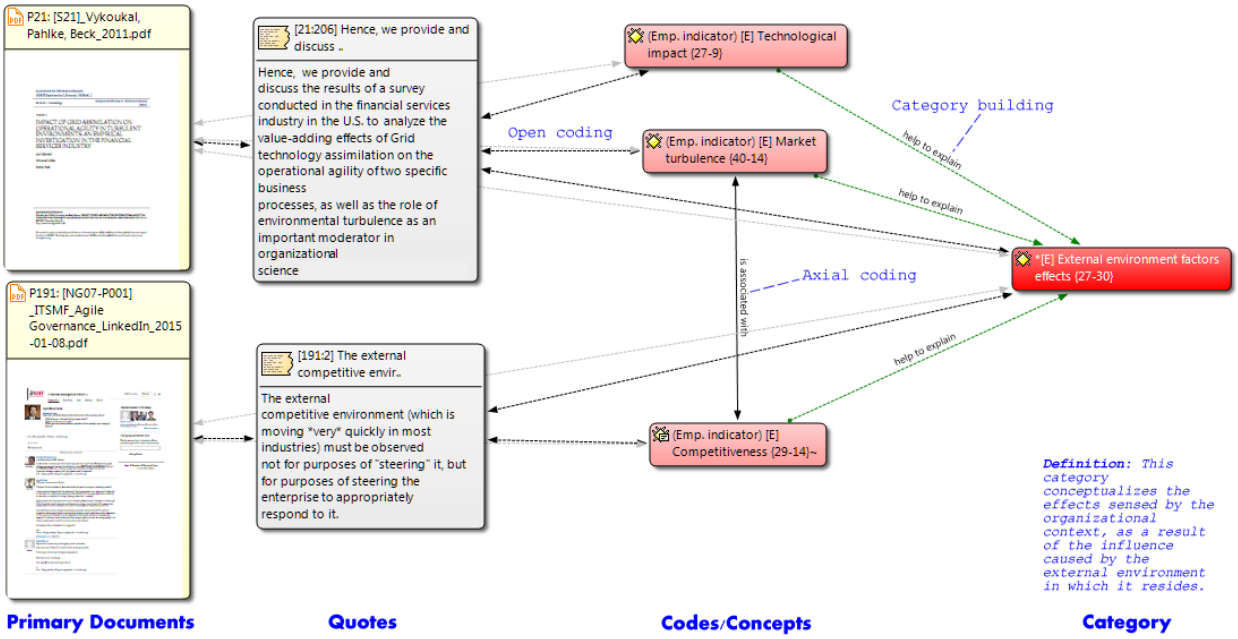

Figure 2.8 – Illustration representing the coding process. Source: example extracted from research repository (ATLAS.ti).

2.5.2 Data Synthesis

In order to identify which categories were representative to suggest the theory building blocks (theory units, or constructs) we have worked to develop a conceptual storyline to everyone, in order to build meaning to explain the agile governance phenomena. During this procedure some of the categories were separated, combined, renamed or removed from conceptual repository, to the extent that the understanding of the relationship between them was deepened.

This recursive procedure were narrowed by the occurrence of theoretical saturation. In consonance with Birks and Mills (2010) we observe that the "*categories were theoretically saturated when new data analysis, emerged codes that only fitted in existing categories, and these categories were sufficiently explained in terms of their properties and dimensions*".

We also, have used the ***nomological network approach*** to analyze construct validity during the data synthesis procedure. The "nomological network" was an idea conceived by Cronbach and Meehl (1955) as part of the efforts to develop standards to construct validity and psychological

testing. The term "nomological" is derived from Greek and means "lawful", so this network can be thought of as the "legitimate network". The nomological network is Cronbach and Meehl's view of construct validity.

The *nomological network*, from the theoretical reference and/or study sampling, reports the observable properties of the related constructs, the constructs themselves and which makes it differs from each other (Brahma, 2009; Preston and Karahanna, 2009; Schwab, 1980).

The condition for a construct can be admitted by Science is that at least some of its correlates are observable. The construct investigated need not be directly observable (by means of an experiment or other empirical studies) it can be articulated in a *nomological network* that is valid and able to make predictions (Bagozzi et al., 1991). This type of network would include the (i) *theoretical framework* for what you are trying to measure, an (ii) *empirical framework* for how you are going to measure it, and (iii) specification of the linkages among and between these two frameworks.

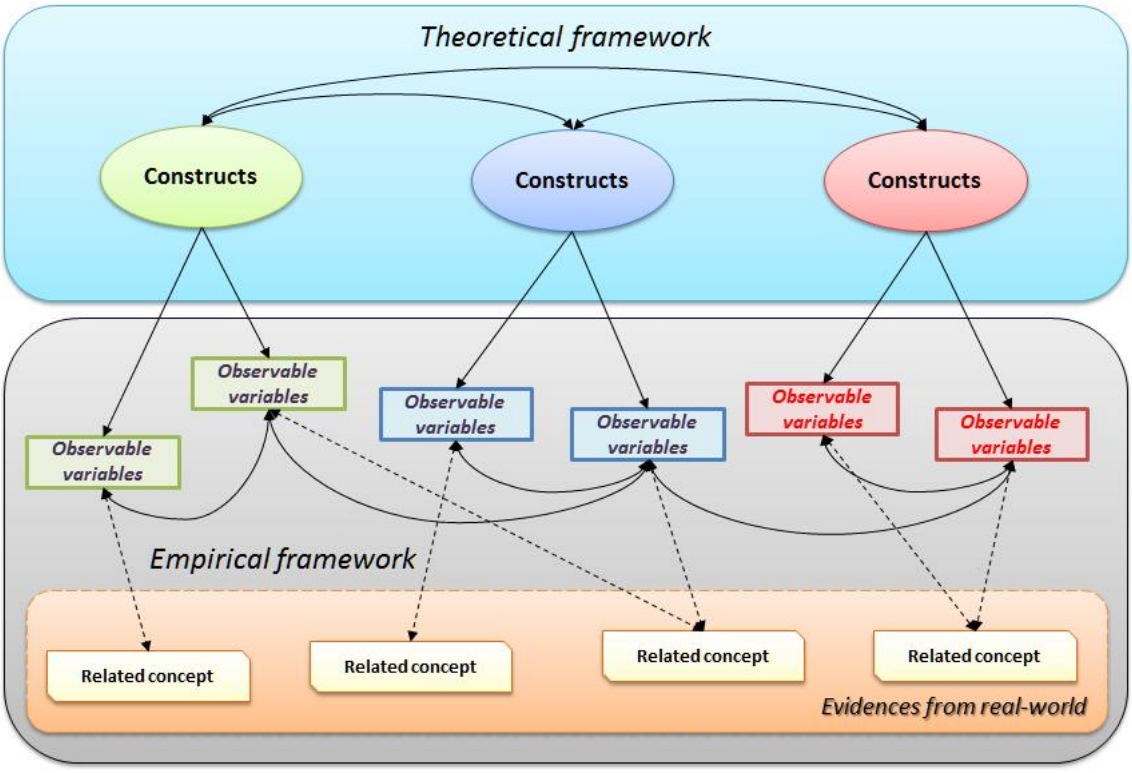

Figure 2.9 – Nomological network architecture for constructs validity. Source: Adapted from Cronbach and Meehl (1955).

Based on Cronbach and Meehl (1955), **Figure 2.9** depicts a schematic nomological network, comprising: (1) **Theoretical framework**: theory units (constructs); (2) **Empirical framework**:

empirical indicators for each construct; (3) **Evidences from real-world**: concepts from distinct sampling sources, through which the theoretical and empirical framework emerges.

For each construct identified (depicted in **Table 4.3)** we have developed a *nomological network* for construct validity, in the interest of develop a conceptual storyline for constructs, and in order to build meaning to explain the agile governance phenomena, including: (i) each theory unit; (ii) its empirical indicators; (iii) related concepts (observed from distinct source sampling); as well as, (iv) characterization of linkages among and between these components. For instance, the **Figure 4.2** (in Section 4.3.1.1.2) depicts *Competitiviness storyline*, as a piece of the *nomological network* developed for the construct "effects of environmental factors" [E], from which a sample was extracted and depicted in **Figure V**.1 at APPENDIX V.1.

The results of data synthesis are described in the Section 4.3.1, and throughout the Chapter 4, as well as more details about it are available in APPENDIX V.1. The development of *nomological network* to measure construct validity was a very useful input for the *theory operationalization* (specially for *step six*, the identification of *empirical indicators*, of the Dubin's theory-building method, see Section 4.4.2), as well as to the subsequent empirical study that was applied in theory testing (see Section 5.2).

As previoulsy mentioned, we have adopted the use of the Dubin's quantitative method of theory building for applied disciplines (Dubin, 1978), as the tool for convergence and synthesis for the conceptual development and operationalization of the emerging theory. The motivation to adopt Dubin method will be described in the following section. Likewise, the application of Dubin's method will be discussed in detail during the development of the theory in Chapter 4.

2.5.3 Why use Dubin's method for theory building research?

Having identified the study design, our philosophical stance, methods, and characterized the nature of theory proposed by this work — we will argue about the selected theory-building method. Specifically, we assessed the following theory-building methods: (1) Dubin's Theory-Building Method; (2) Grounded Theory-Building; (3) Software Engineering Theory-Building Framework; and (4) Lynham's General Method — against the selection criteria. This analysis revealed that Dubin's Theory Building Method was best suited for this study in combination with some techniques from Grounded Theory, as depicted in **Table 2.5**.

Table 2.5 – Theory-Building Method comparison. Adapted from: (Torraco, 2002).

Theory-Building Method	Strengths	Limitations	Completeness
Dubin's Theory Building Research Method (Dubin, 1978)	(1) Can be used for hypothetico-deductive knowledge creation. (2) Offers a specific, multi-step process for theory building. (3) Each step of theory building is clearly specified and interrelated to other steps. (4) The method is comprehensive in providing for the initial development of a theory and for the research to verify the theory.	This methodology has been criticized as *linear, sequential*[17], and unable to adequately represent the fluidity and emergent nature of many social and organizational phenomena.	Encompasses all 5 phases in Lynham's General Method and the steps from Sjøberg et al. framework for SE.
Grounded Theory (GT) Building (Corbin and Strauss, 1990)	(1) Is of particular value for generating new insights and tentative hypotheses. (2) Method's commitment to closeness of fit between theory and data yields theory with strong descriptive and explanatory power.	It should not be used when breadth and generalizability of theoretical explanation are sought.	Does not encompass confirmation or disconfirmation.
Theory-Building Framework for Software Engineering (SE) by Sjøberg et al. (2008)	(1) Tries to simplify the process of theory building.	(1) Presents an incomplete sequence of steps for theory building. (2) Some steps seem positioned at the non-adequate sequence, e.g., definition of proposition before the explanation.	Does not encompass hypotheses definition, system states and empirical indicators.
Lynham's General Method (Lynham, 2002b)	(1) Presents five simple steps to be followed. (2) Presents a stage for theory refinement.	(1) Too much generic description. (2) There are no enough details (instructions, rationale) to be followed by beginner's theorists.	Does not encompass detailed operationalization of theory.

In line with the study's criteria, Dubin's theory building research method is based on a deductive, theory-then-research strategy (Dubin, 1978; Lynham, 2002a; Mot, 2010). In Dubin's method theory is developed as a hypothesis based on logic and what is known about the constructs and then tested and validated with empirical data. Also, in accordance with this study's requirements, Dubin (1978) method best fits within the pragmatism philosophical perspective (Dubin, 1978, 1976; Gay and Weaver, 2011; Shah and Corley, 2006). Dubin's approach to theory building research is to make sense of the observable world by identifying a phenomenon's key constructs and determining the relationships among them. Dubin's method

[17] Argument that we disagree, as discussed in Section 2.5.4.

encompasses the complete theory-building process (Torraco, 2002). As stated by Lynham (2002a, p. 244): "*following the form and substance of* [Dubin's method] *is considered necessary and sufficient to ensure both rigor and relevance in the resulting theory*".

The first four of Dubin's eight research steps comprise the first part of the theory building research process, which entails conceptual development of the theory (or theoretical model). The steps in this part of the theory-building process include:

1. Identification and definition of the units of the theory (i.e. the elements that interact to create the phenomenon, or constructs);
2. Determination of the laws of interaction that state the relationships between the units of the theory;
3. Definition of the boundaries of theory to help focus attention on forces that might impact the interplay of the units;
4. Definition of the theory's system states (i.e., different situations which may affect the interaction of the theory's units).

After completing part of one the theory-building process, the research begins part two: research operation. This part of the theory building research process entails operationalizing and testing the theory. The steps involved in this part of the theory building research process include:

5. Defining propositions from the theoretical model that are to be considered logical and true;
6. Identifying empirical indicators, which can be measured, for each key point to be tested;
7. Generating testable hypotheses or research questions;
8. Testing the hypotheses by means of an empirical study.

For a better understanding, **Figure 2.10** provides a positioning of the Dubin's method into the (A) research framework depicted in Figure 2.1, as well as an illustrative comparison among (C) Dubin's method, (D) the five steps proposed by Sjøberg et al. (2008) for theory building in Software Engineering, and indicates how it can be integrated with the phases in Lynham (2002b) General Method.

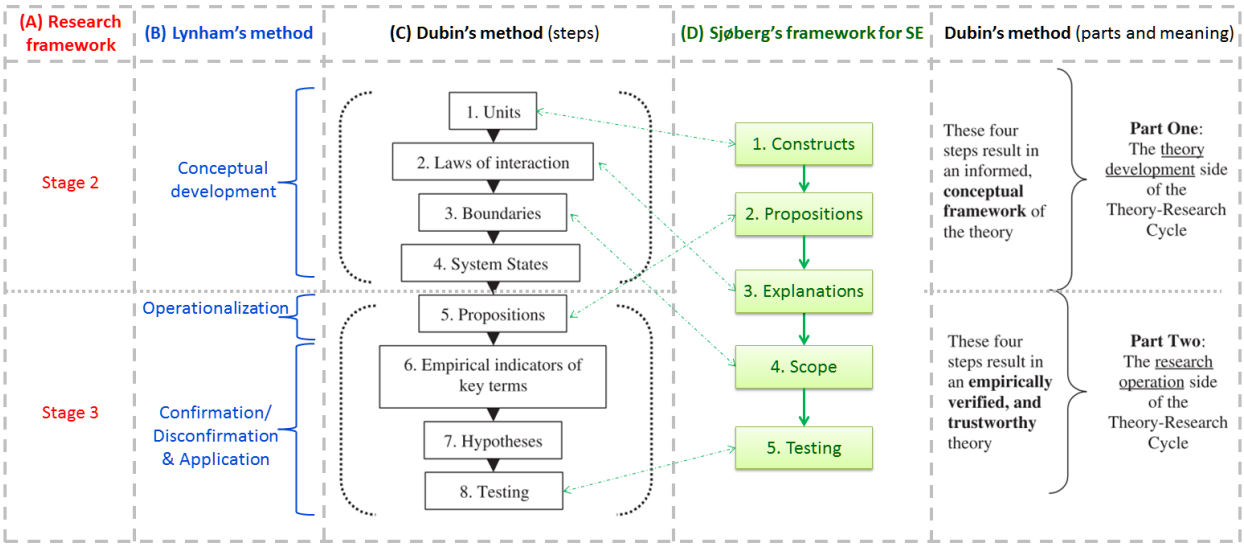

Figure 2.10 – Dubin's method compared. Adapted from: (Lynham, 2002a, 2002b; Sjøberg et al., 2008)**.**

Indeed, Dubin's method includes eight steps that progress through and address each of the five phases Lynham (2002b) describes as necessary for theory building research, as well as each of the five steps proposed by Sjøberg et al. (2008) for theory building in Software Engineering.

In short, we have decided adopt the Dubin's method for theory building on our research, because: (1) the wide coverage provided by his method in comparison with others theory building methods, as evidenced by the discussion developed on this Section; and, (2) by virtue of the correct interpretation his method, added to some methodological precautions held (both discussed in Section 2.5.4), which overcome most of the alleged constraints pointed out by few authors such as (Lynham, 2002a; Torraco, 2002).

2.5.4 Design of a Theory: deepening the methodological approach

When we look at Figure 2.10, the first idea that comes to mind is that Dubin's method is "*linear, sequential*" and without refinement cycle. Actually, even Torraco (2002) points out that issue as a limitation of this method (see **Table 2.5**).

This issue is also reinforced by the fact that the best known graphical representation of the Dubin's method was popularized by Lynham (2002a, p. 243) in her book chapter "*Quantitative Research and Theory Building: Dubin's Method*" in "*Advances in Developing Human Resources*". In fact, the *Fig. 1* from her book chapter (adapted in Figure 2.10, as column C) conveys the idea that Dubin's method is "*linear, sequential and without refinement cycle*".

However, after reading the Dubin's book "*Theory building: a Practical Guide to the Construction and Testing of Theoretical Models*" our opinion is that the representation of the Dubin's method proposed by Lynham (2002a) "does not do justice" to the rich description, generously provided by Dubin (1978) in his book.

Unfortunately, maybe Dubin has some guilt on that issue, because in none of the 304 pages of his book there is no graphical representation of the method, despite the eloquent description and abundant number of examples and analogies.

So, avoiding discussing that Lynham (2002a) was unhappy in her graphical representation of the Dubin's method, as well as Torraco (2002) may have been influenced by the Lynham (2002a) figure, we would like to introduce our own view about the Dubin's method in **Figure 2.11**, making explicit the feedback cycle for each step of the method.

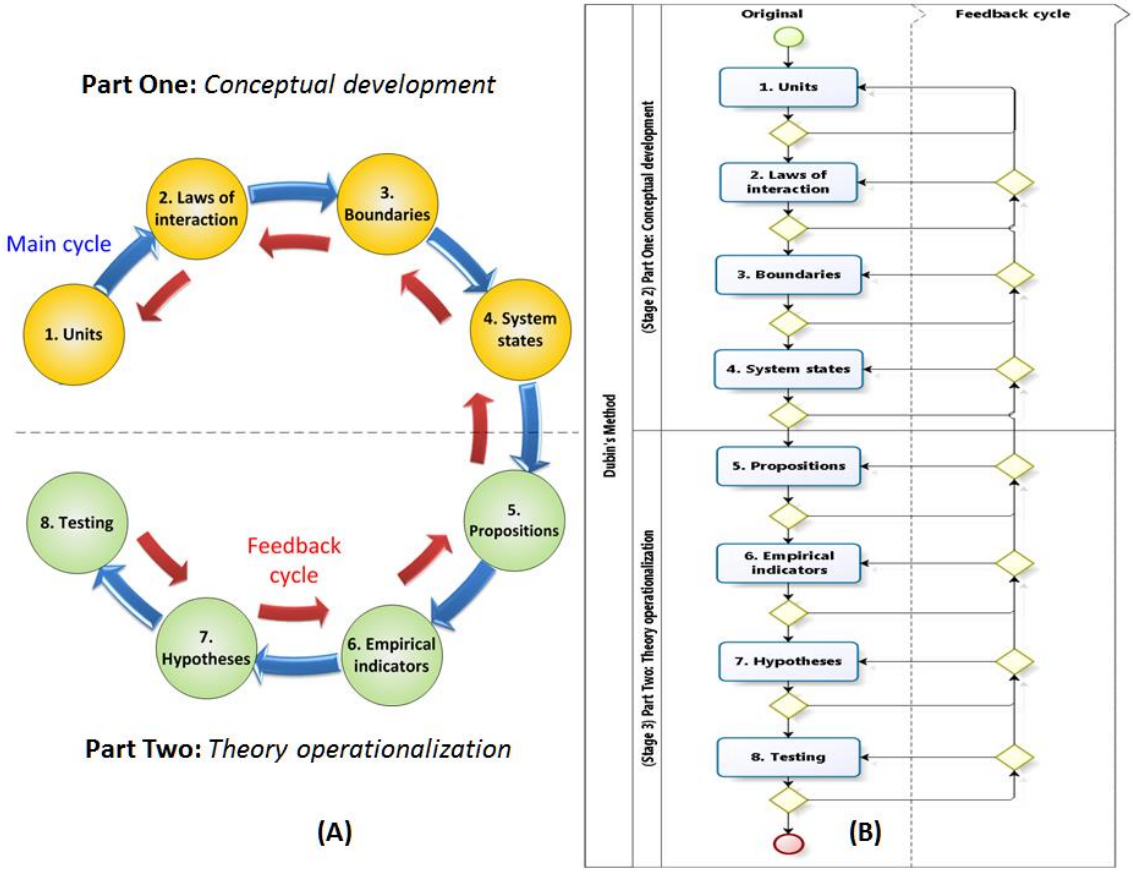

Figure 2.11 – Dubin's method: including feedback cycle. **Adapted from**: Dubin (1978).

The second limitation highlighted by Torraco (2002) about the Dubin's method, is that it is "*unable to adequately represent the fluidity and emergent nature of many social and organizational phenomena*". In order to overcome the pointed out limitation, and minimize potential bias that could come from it, we have added some techniques from Grounded Theory on our research framework to collect, analyze and synthesize the data extracted from the

different sources and samples chosen by this research, such as: theoretical sampling, coding and categorization of data; constant Comparative Analysis (CCA), among others. Therefore, we have combined the inductive nature of the Ground Theory approach with the hypothetico-deductive nature of the Dubin's method, bringing together the best of both methodological worlds.

2.6 Theory Assessment

2.6.1 Why adopt Structural Equation Modeling to assess theory?

When Dubin (1978) discusses about strategies to discover units of a theory, he points out Factor Analysis as an specially powerful tool for inventing new units by subdivision and assess theoretical model by hypotheses testing (p. 82). Dubin (1978) continues advocating "*the particular beauty is that it [Factor Analysis] provides an objective way for determining how far one goes in the factoring process and when to stop*." (p. 82). The technique has been employed primarily in psychology, where it was developed, and is only lately coming into use in sociology and anthropology.

In addition, Marôco (2014) highlights **Structural Equation Modeling (SEM)** as a generalized modeling technique, used to test the validity of theoretical models, which define hypothetical and causal relations among variables. Those relations are represented by parameters that indicate the magnitude of the effect of independent variables upon dependent ones, in a composite of hypotheses relating to pattern associations among variables.

According to Marôco (2014), the SEM was being developed in the first half of the twentieth century from the seminal works of (Wright, 1934, 1921) about "Path Analysis" and (Spearman, 1904) work about "Factor Analysis". The SEM is an extension of generalized linear models that considers, in an explicit way, the measurement errors associated with the variables under study. In more simplistic terms SEM can be described as a combination of classical techniques of *Factor Analysis* (that defines a model as operationalized latent variables or constructs) and of *Linear Regression* (establishing, in the structural model, the relationship between the different variables under study). However, in line with Marôco (2014) SEM is more than the sum of these two techniques.

In keeping with Marôco (2014), SEM is based on a *theoretical framework* established previously. Thus, the null hypothesis specifies the model that the researcher believes to be valid, and the data serve to demonstrate that the theoretical model explains conveniently (or approximately) the relationships observed among the measured variables.

Using SEM, the researcher starts by formulating the *theoretical framework* and then collect data to confirm, or not, this theoretical framework. The *theory is the engine of analysis*, contrary to *classical statistical paradigm* in which data, not the theory, are at the heart of the research process. The observation that a particular theoretical model is appropriate to explain the relational structure of the data does not prove that this model is unique. This only shows that the *theoretical framework envisaged is appropriate for the data under observation*, not excluding other theoretical models also defensible.

In fact, SEM may be used as a more powerful alternative to multiple regression, path analysis, factor analysis, time series analysis, and analysis of covariance. That is, these procedures may be seen as special cases of SEM, or, to put it another way, SEM is an extension of the general linear model of which multiple regression is a part.

SEM allows both *Confirmatory Factor Analysis* (CFA) and *Exploratory Factor Analysis* (EFA) modeling, meaning they are suited to both theory testing and theory development. CFA allows the researcher to test the hypothesis that a relationship between the observed variables and their underlying latent construct(s) exists. The researcher uses knowledge of the theory, empirical research, or both, postulates the relationship pattern a priori and then tests the hypothesis statistically (Thompson, 2004).

Specifically, confirmatory modeling (CFA) usually starts out with a hypothesis that gets represented in a causal model. The concepts used in the model must then be operationalized to allow testing of the relationships between the concepts in the model. The model is tested against the obtained measurement data to determine how well the model fits the data. The causal assumptions embedded in the model often have falsifiable implications which can be tested against the data (Pearl, 2000).

At long last, *taking in mind all these points discussed here, we consider SEM and CFA as proper and suitable techniques to assess the emerging theory*. Moreover, use of SEM to test the outcome of the Dubin's method, seems a good alternative to assess whether the theoretical

model derived (using SEM) from emerging theory is appropriate to explain the relational structure of the data that will be collected to carry out the CFA.

Figure 2.12 summarizes the SEM procedure in seven steps: (1) theoretical model design; (2) specification and identification of the model; (3) data collection; (4) model estimation; (5) assessment of model quality adjustment; (6) model evaluation; (7) acceptance or rejection the model's hypotheses.

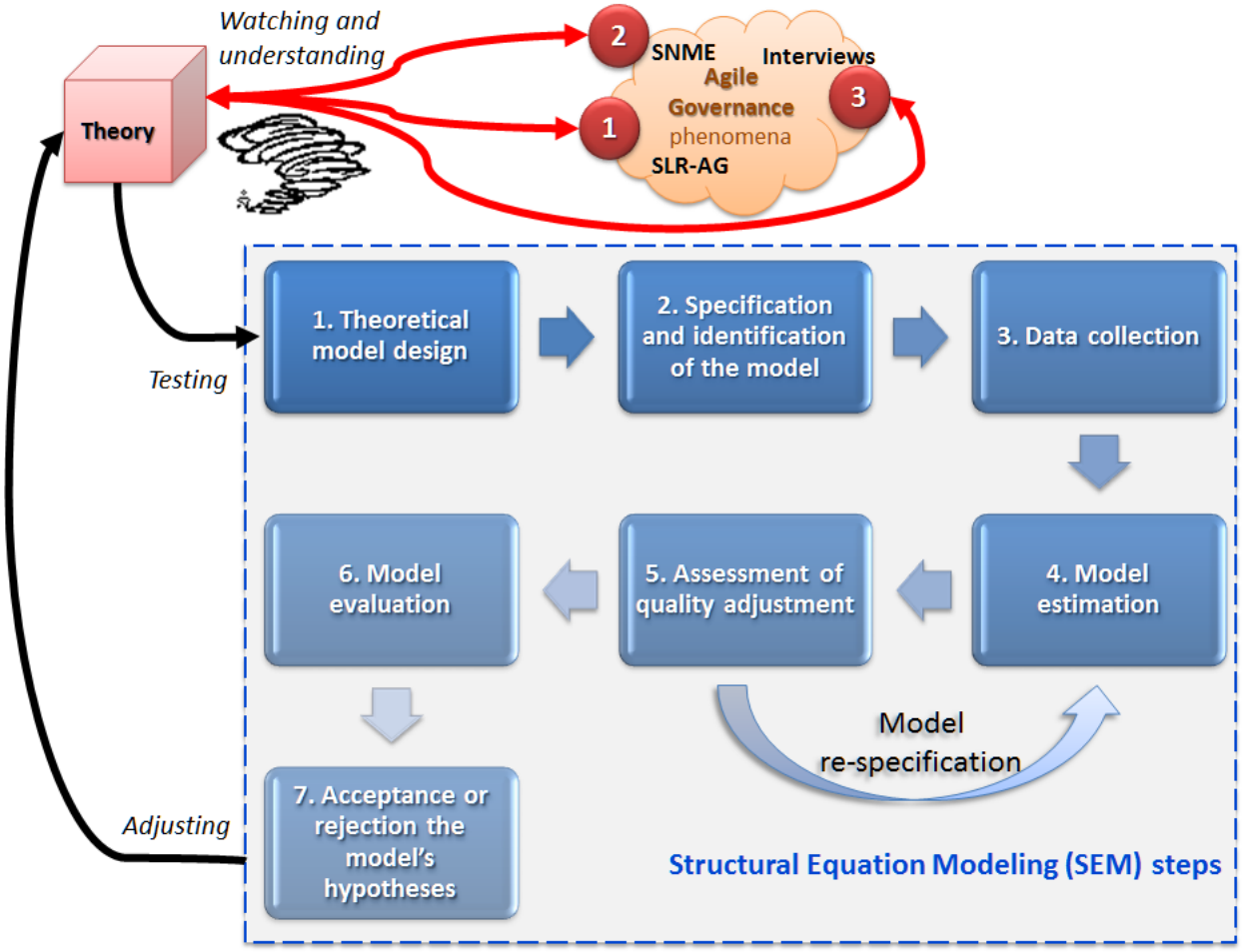

Figure 2.12 – Structural Equation Modeling (SEM): analysis steps. Adapted from: Marôco (2014).

The approach of all these steps will be detailed throughout the Chapter 5. For instance, at the step (5) of the **Figure 2.12**, for assessing model fit criteria, we should to check how well the theoretical model formulated by the researcher matches the correlational structure of the variables observed in the data sample, in other words, the correspondence between the matrix of covariances provided by the theoretical model and the one generated by empirical data. **Table 2.6** brings together the most used indexes to verify the model fit with their respective benchmarks.

Table 2.6 – Quality indices of the SEM model adjustment. Source: Marôco (2014, p. 55) and Mulaik (2009).

Index	Variable	Reference values
χ^2; p-value	Measures the discrepancy between the theoretical model and the data sample.	The smaller, the better; p $>$ 0.05
χ^2/gl	Being the sensitive chi-square to the sample size, it is useful to standardize the index by dividing it by the degrees of freedom.	$>$ 5; bad fit ⌋ 2, 5⌉; acceptable fit ⌋ 1, 2⌉; good fit ~ 1; Very good fit
CFI (*Comparative Fit Index*)	Standardized incremental indices that measure the model fit for a specific range of values.	<0.8; bad fit [0.8; 0.9 [; acceptable fit [0.9; 0.95 [; good fit ≥0,95; very good fit
GFI (*Goodness of Fit Index*)		
NFI *(Normed Fit Index)*		
TLI (*Tucker Lewis Index*)		
AGFI (Adjusted Goodness of Fit Index)	GFI adjusted for degrees of freedom of the model.	$>$ 0.9
RMSEA (Root Mean Square Errors of Aproximation)	Measures the quality of the model fit to the covariance matrix of the sample, taking into account the degrees of freedom	$>$ 0.10; unacceptable fit ⌋ 0.05, 0.10⌉; good fit ≤0.05; very good fit p-value ≥0.05
Parcimony Indices: • *Parsimony GFI (PGFI), based on GFI* • *Parsimony CFI (PCFI), based on CFI* • *Parsimony NFI (PNFI), based on NFI*	These fit indices are relative fit indices that are adjustments to most of the ones above. The adjustments are to penalize models that are less parsimonious, so that simpler theoretical processes are favored over more complex ones. Mulaik (2009) developed a number of these. Although many researchers believe that parsimony adjustments are important, there is some debate about whether or not they are appropriate. Many authors agree that researchers should evaluate model fit independent of parsimony considerations, but evaluate alternative theories favoring parsimony. With that approach, we would not penalize models for having more parameters, but if simpler alternative models seem to be as good, we might want to favor the simpler model.	The more complex the model, the lower the fit index. Values for those indices >0.60 are widely accepted by most scholars in this topic.

2.6.2 Theory comparison and supplementary assessment

Also, we have carried out theory comparison in exchange for pull in extant theory to compare and contrast with the proposed theory, also to examine what is similar, what is different, and why, in order to enhance the *internal validity*, *generalizability*, and *theoretical level of the theory building*. This process is detailed in Section 5.3.

At the same time, in Section 5.4: (1) we have applied the Glaser's criteria (Glaser, 1992) to evaluate the theory's *credibility*; and, (2) Angen's approach (Angen, 2000) to conduct a validation from the *ethical* and *substantive* perspectives; as well as (3) we have assessed the emerging theory under the criticism lens of Sutton and Staw (1995).

2.7 Methodological reflections

Aiming to dispel any doubt about the application of the main methods adopted in this thesis we elaborate **Figure 2.2**, which depicts a detailed description of the application of each method presented in research framework portrayed in **Figure 2.1**. Hence, **Figure 2.2** can be considered a comprehensive map for reproduction of each step of this work, as well as a contextualized illustration of the utilization of each method.

Under a *pragmatic perspective*, this research is a "*research-then-theory-then-research strategy*", evidenced by the research phases of our *research framework*:

(1) **Theory emergence**: firstly, we have conducted empirical investigations (SLR, Observation on professional groups based on Social Networks, and Semi-structured interviews) before formulating an explicit theory (that would permit predictions and hypothesis testing), on the grounds that empirical investigation motivated by informed speculation may itself be productive for theory-building.
(2) **Theory assessment**: after that, we have carried out an experimentation that depends upon first formulating a theory (emerged at prior phase), which it has made predictions (see hypothesis) that we can test by empirical investigation, for the further refinement (if not immediate endorsement or complete abandonment) of the ongoing theory.

Eventually, some details about the application of each method employed on this research can be presented during the descriptions of the results on the following Chapters, but the explanation of the methodological approach is condensed in this chapter that ends here.

2.8 Closing remarks

This chapter has described the general research strategy of this work. We have developed a detailed description of the research design by means of methodological framework, as well as it was characterized the procedural approach adopted to conduct this research.

The presented *research framework* is quite useful, mainly to understand how it was carried out the integration of both qualitative and quantitative approaches in a set of studies. Likewise, this Chapter describes, in short, each method and technique adopted, as well as it highlights the combined application of each one in the context of this research.

In the next Chapter, the theoretical background and related work will be explored, including findings of our Systematic Literature Review that were so relevant to help us to build a big picture about the state of the art of the agile governance phenomena.

Chapter

3

3. State of the art of Agile Governance: background and related work

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This chapter aims to present the state of art of agile governance domain, helping to better understand how agile governance is applied on organizational context.

3.1 Introduction

Conforming to Fettke (2006), the world-wide increasing amount of literature makes it necessary to describe, to synthesize, to evaluate, to clarify, or to integrate the results of papers in a particular field of research. Indeed, currently the process of conducting a literature review is seen as a scientific procedure, which should be guided by appropriate research methods. The term "state of the art" regards to the topmost level of general development, as of a device, technique, or scientific field achieved at a particular time.

This chapter investigates how the domain of Agile Governance is evolving, as well as derives implications for research and practice. In other words, it analyzes the achieved level of research and practice in this domain, from a broad point of view: (i) initially, seeking understand the meaning and essence of some key terms on the topic in study; (ii) characterizing the field of governance, its root ideas, also how this domain have connection with other disciplines; (iii) presenting the results from the Systematic Literature Review, carried out at the *stage 1* of research framework depicted in Figure 2.1, which help us to understand how agile governance is applied on organizational context, and, also, providing innovative knowledge for development of this work.

3.2 What is Governance?

According the European Commission (2003), the word **governance** derives from the Greek verb ***κυβερνάω*** [*kubernáo*], which means to *steer* (to *guide*, to *govern*) and it was used for the first time in a metaphorical sense by Plato (380 BC) in his work The Republic (Bloom, 1991). As reported by US Department of State (1944), this term began to spread worldwide by the International Monetary Fund (IMF) and World Bank (WB), from the Bretton Woods Conference.

The World Bank (1991) defines governance as: "*the manner in which **power** is exercised in the **management** of a country's economic and social resources for **development***".

At the same time, the *Worldwide Governance Indicators* project of the World Bank (2006) defines governance as: "*the traditions and institutions by which **authority** in a country is exercised*".

Indeed, these definitions refer to the processes by which governments are selected, monitored and replaced. In addition, they address the ability of the government to formulate and implement consistent policies, also highlighting the respect of citizens, the state institutions that govern economic and social interactions among them effectively.

Alternatively, Bell (2002) sees governance definition as: "*the use of institutions, **structures** of authority and even **collaboration** to allocate resources and **coordinate** or **control** activity in society or the economy*".

On a report about Governance in Indonesia McCawley (2005) from *Asian Development Bank Institute* - Tokyo, try summarizes the governance definition as:

> • "*The processes by which governments are **chosen**, **monitored**, and **changed**.*
> • *The systems of **interaction** between the administration, the legislature, and the judiciary.*
> • *The ability of government to create and to implement public **policy**.*
> • *The **mechanisms** by which citizens and groups define their **interests** and interact with institutions of authority and with each other."*

In addition, on the same report, McCawley (2005) cites three other definitions to term governance, follows:

1. "*Governance is the exercise of political, economic and administrative authority to manage a nation's affairs. It is the complex mechanisms, processes and institutions through which citizens and groups articulate their interests, exercise their legal rights and **obligations**, and **mediate** their differences.*" According to *UNDP - United Nations Development Programme's* (United Nations, 2013a).
2. "*Governance is the manner in which power is exercised in the management of a country's social and economic resources for development. Governance means the way those with power use that power."* According to *ADB - Asian Development Bank* (Asian Development Bank, 2013).
3. Governance is *"… the traditions and institutions by which authority in a country is exercised for the **common good**. This includes (i) the **process** by which those in authority are selected, monitored and **replaced**, (ii) the capacity of the government to effectively manage its resources and implement sound policies, and (iii) the respect of*

> *citizens and the state for the institutions that govern economic and social interactions among them.*" As stated in (World Bank, 2002).

Along with the *United Nations Development Programme's Regional Project on Local Governance for Latin America*, in (United Nations, 2013b):

> "*Governance has been defined as the **rules** of the political **system** to solve **conflicts** between actors and adopt **decision** (legality). It has also been used to describe the 'proper functioning of institutions and their acceptance by the public' (legitimacy). And it has been used to invoke the efficacy of government and the achievement of **consensus** by democratic means (participation)*".

Calame and Talmant (1997) introduce one of the best definitions to **governance**, that synthetizes the most important and distinctive aspects, while at the same time generalizing and universalizing the approach:

> *"Governance is the ability of human societies to **equip** themselves with systems of **representation**, institutions, processes and social structures, in order to they manage themselves, through a **voluntary** movement*".

In retrospect, performing a pragmatic philosophical rationalization of the term governance, taking into account all of those nine definitions, is it possible to suggest that this ability of "*voluntary organization for direction and action*" (when we are able to be aware of it), in other words, the ability to "*sense and respond*" (knowingly, voluntarily and rationally), is the essence of the meaning of governance, as well as this "*voluntary organization*" is what differentiates humans from other living beings.

At the same time, during this brief exploratory literature review, some keywords were identified and marked in bold, on each definition collected for posterior analysis. These keywords were organized in three groups of ideas, follows:

1. **Drive force**: in this group were associated with keywords that convey the idea such as: "provocation", "origin", "what motivates".

2. **By means of**: in this group were associated with keywords that convey the idea such as: "how to do", "how it happens", "how it can be conducted".

3. **Aim**: in this group were associated with keywords that convey the idea such as: "goal", "objective", "result", "benefit".

Table 3.1 depicts the keywords organization after this classification approach. Naturally, some keywords were classified in more than one group; due to them can be used in different contexts, such as: **authority**, **rules** and **consensus**. These keywords were marked in bold in Table 3.1.

Table 3.1 – Contextualization of keywords collected from *governance* definitions.

(A) Driving force	(B) By means of	(C) Aim
power **authority** **policy** chosen obligations **rules** **consensus** representation voluntary	management **authority** structures collaboration coordinate **control** monitored **policy** interaction mechanisms process **rules** system decision equip	development changed mediation common good replaced conflicts (mediate, minimize) **consensus** ***responsibility***

For example, the keyword **authority** can be used on a *driving force* sense, whether can be interpreted as a “motivation” (or an inducement) to steering (or guiding) in a governance context, e.g., "*create authority to stablish a constitutional state (rule of law)*".

On the other hand, the same keyword also can be considered as a “means to ensure" the same guidance (governance), conveying the idea of "how to". For example: "*use the authority to maintain social order and to ensure that constitutional organs can perform their functions: courts, parliaments, etc.*”

As a matter of fact, we realize that the most part of the definitions collected are much more focused on how governance should be applied (addressing the "by means of" idea), than concerning to its originator aspects (“driving force” sense), or its purposes (aim). Hence, we can assume that a good definition of governance should be simple enough to cover all these aspects identified by the keywords and balanced enough to be accurate in each of the groups’ idea: drive force, by means and aims. What is a big challenge!

At long last, governance is primarily related with mechanisms and responsibilities through which the authority is exercised, decisions are made and the strategy is coordinated and steered on the organizations, whether they are a country, an enterprise, a specific sector or a project. Indeed, this work will adopt this last governance definition stated by Calame and Talmant (1997) for the discussions that will follow along this thesis.

3.3 Corporate Governance

In point of fact, **corporate governance** became a pressing issue following the 2002 introduction of the Sarbanes-Oxley Act in the U.S. (Congress of the United States of America, 2002), informally referred to as SARBOX or SOX, which was ushered in to restore public confidence in companies and markets after accounting fraud bankrupted high-profile companies such as Enron and WorldCom (Boaz and Crane, 2003). Most companies strive to have a high level of corporate governance. Currently, it is not enough for a company to merely be profitable; it also needs to demonstrate good corporate citizenship through environmental awareness, ethical behavior and sound corporate governance practices.

Usually, contemporaneous discussions about corporate governance are directed to principles raised in three documents: (i) The *Cadbury Report* (Cadbury, 1992); (ii) the *Principles of Corporate Governance* (OECD, 2004); and, (iii) the *Sarbanes-Oxley Act of 2002* (Congress of the United States of America, 2002). The Cadbury and OECD reports present general principals around which businesses are expected to operate to assure proper governance. The Sarbanes-Oxley Act is an attempt by the federal government in the United States of America to legislate several of the principles recommended in the Cadbury and OECD reports.

The *Cadbury Report* (Cadbury, 1992), is a report of the *United Kingdom Financial Committee chaired* by *Adrian Cadbury* that sets out recommendations on the arrangement of company boards and accounting systems to mitigate corporate governance risks and failures. The report's recommendations have been adopted in varying degree by the *European Union*, the *United States*, the *World Bank*, and others. According to this report:

> *"Corporate governance is the system by which **companies** are directed and controlled. Boards of directors are **responsible** for the governance of their companies. The shareholders' role in governance is to appoint the directors and the auditors and to*

> *satisfy themselves that an appropriate governance structure is in place. The **responsibilities** of the board include setting the company's strategic aims, providing the **leadership** to put them into effect, supervising the management of the business and reporting to shareholders on their stewardship. The board's actions are subject to laws, **regulations** and the shareholders in general meeting."*

On the other hand, the *Canadian government* (Canada Government, 2013) adopts the definition established by the *Organization for Economic Cooperation and Development* (OECD, 2004), that defines corporate governance as:

> *"a set of relationships between a company's management, its board, its shareholders, and other stakeholders. Corporate governance also provides the structure through which the objectives of the company are set, and the means of attaining those objectives and monitoring performance are determined. Good corporate governance should provide proper incentives for the board and management to pursue objectives that are in the interests of the company and its shareholders and should facilitate effective monitoring."*

At the same time, according (Investopedia, 2013), which is one of the Internet's largest sites devoted entirely to investments and financial education, **corporate governance** is:

> *"The system of rules, practices and processes by which a company is directed and controlled. Corporate governance essentially involves balancing the interests of the many stakeholders in a company - these include its shareholders, management, customers, suppliers, financiers, government and the community. Since corporate governance also provides the framework for attaining a company's objectives, it encompasses practically every sphere of management, from action plans and internal controls to performance measurement and corporate disclosure."*

Also, according the *European Conference on IS Management, Leadership and Governance* (ECMLG, 2005) organizational governance is the mechanism organizations use to achieve their vision and mission for the future.

Eventually, simplifying the definition proposed by the Cadbury (1992) in his report, which is quite popularized in internet, corporate governance:

> *"is the set of processes, policies, rules, laws and institutions that **affecting the way as a corporation** is **directed**, **administered** and **controlled**".*

Indeed, because this last one is a simple definition, direct and objective, and because it captures the essence of this concept, highlighting the difference between governance and corporate governance, this work will adopt this latter definition of corporate governance as a reference for the discussions that will follow in the remaining Sections of this document.

3.4 IT Governance

Before proceed, it is important to clarify that "IT"[18] or "ICT"[19] will be used as synonyms in this document, to encompass the infrastructure as well as capabilities, resources, assets and arrangements that establish and support the "technology", and its application on organizational context.

According to IT Governance Institute (2001), the discipline of **IT governance** first emerged in 1993 as a derivative of corporate governance and deals primarily with the connection between strategic objectives and IT management of an organization.

The growing interest in IT governance is partly due to the need to ensure reliable security and auditing mechanisms for companies, in order to mitigate business risk and avoid the occurrence of frauds (or ensure that there are means to identify them), ensuring transparency in management. The Sarbanes-Oxley Act (Congress of the United States of America, 2002), in U.S., and the Basel Accords (Bank for International Settlements, 2010) in Europe, are examples of statutory mechanisms in this context. The Basel Accords refer to the *Worldwide Banking Supervision Accords* — Basel I, Basel II and Basel III—issued by the *Basel Committee on Banking Supervision* at the *Bank for International Settlements* in Basel, Switzerland, where the committee normally meets.

As indicated by IT Governance Institute (2001) the primary goals for IT governance are:

(1) To assure that the **investments** in IT generate **business value**, and

(2) To mitigate the **risks** those are associated with IT.

[18] Information Technology.
[19] Information and Communication Technologies.

In fact, this can be done by implementing an organizational structure with well-defined roles for the responsibility of information, business processes, applications, IT infrastructure, etc. Also, accountability is one of the key concerns of IT governance.

The *IT Governance Institute's* publication, *Board Briefing on IT Governance*, 2nd Edition in (ITGI et al., 2001) defines:

> *"IT governance is the responsibility of the board of directors and executive management. It is an integral part of enterprise governance and consists of the leadership and organizational structures and processes that ensure that the organization's IT sustains and extends the organization's strategies and objectives."*

Moreover, in keeping with Gartner Group (2013):

> *"IT governance (ITG) is defined as the processes that ensure the effective and efficient use of IT in enabling an organization to achieve its goals. IT demand governance (ITDG—what IT should work on) is the process by which organizations ensure the effective evaluation, selection, prioritization, and funding of competing IT **investments**; oversee their implementation; and extract (measurable) business **benefits**. ITDG is a business investment decision-making and oversight process, and it is a business management **responsibility**. IT supply-side governance (ITSG—how IT should do what it does) is concerned with ensuring that the IT organization operates in an effective, efficient and compliant fashion, and it is primarily a CIO responsibility."*

Along with, according to IT Governance Network (2013):

> *"IT governance is the board's **ability** to **direct** and **control** the enterprise's use of **IT resources** in line with **strategic goals**. Leadership, organizational structure and processes are used to leverage IT resources and **drive alignment**, the delivery of **value**, management of **risk**, optimization of resources and **performance** measurement."*

Likewise, the *Australian Standard for Corporate Governance of Information and Communication Technology (ICT)* in (Australian Standard, 2013), defines IT governance as:

> *"Corporate Governance of Information and Communication Technology (ICT) is the system by which the current and future use of ICT is directed and controlled. It involves evaluating and directing the plans for the use of ICT to support the organization and*

> *monitoring this use to achieve plans. It includes the strategy and policies for using ICT within an organization." - AS8015:2005*

On the other hand, according to Dubinsky et al. (2008) the definitions of IT governance that can be found in the literature from (Weill and Broadbent, 1998), (Chulani et al., 2006), (Grembergen et al., 2004), (Weill and Ross, 2004a) and they all share common ideas, such as the need to increase the **value of IT** to the organization while **reducing risk**.

For instance, Weill and Ross (2004) focus on decision rights and define IT governance as: *"specifying the decision rights and **accountability** framework to encourage **desirable behavior** in the use of IT" (p. 8).*

Along with Grembergen et al. (2004), address the alignment of the IT organization with the business needs, and define IT governance as: *"the leadership and organizational structures, processes, and relational mechanisms that ensure that the organization's IT sustains and extends the **organization's strategy** and objectives".*

After an analysis about those IT governance definitions, this work will consider the following simple and balanced definition adapted from IT Governance Institute (2001) for the discussions that will follow along this thesis: "*IT Governance is a subset of Corporate Governance focused on the IT environment, on their performance systems, risk management and investment management*".

3.5 Management

As stated by *Australian Office of the Public Sector Standards Commissioner* (OPSSC, 2015) **management** can be described as:

> *"the process of planning, organizing, directing and controlling organizational resources (human, financial, physical, and informational) in the pursuit of organizational goals".*

Apparently, management consists of the interlocking functions of creating corporate policy and organizing, planning, controlling, and directing an organization's resources in order to achieve the objectives of that policy .

However, contrary to what a superficial observation can lead us to infer, management is not simply a "puppet of governance". Management has its own intransferable key role in the engine that governing the functioning of organizations, whether: companies, Governments, or even NGOs.

Management is often considered as a key factor of success in business and public administration (Teece et al., 1997; Wong, 2005). Management is the glue that binds all the parts of the complex organizational environment, making each part and the whole can generate the necessary response to the achievement of the overall strategy.

In addition, and above all, management is the mobilizing factor of the main driving force of change in organizations: people. In its challenging mission, management has to consider the beauty of people's complexity: their mindset, their differences and similarities, which becomes each team unique and incomparable. In fact, management handles with this intricate environment where cultural aspects, beliefs, freedom, and creativity, i.e., each cited aspect (and many others) influences the whole organizational context (and its surroundings).

In keeping with Saranya and Muthumani (2011), people management is increasingly recognized as a key competitive advantage for companies, as well as a key indicator of a company's success, becoming an important factor in a business's competitive advantage, and correlated with competitive performance. People management involves getting the right people, with the right skills, in the right position, at the right time, rewarding them with the right incentives to perform the right function in the right environment, to most effectively perform the work of the organization.

While people emerge as an unquestionably and valuable asset (as well as, at the same time, a potential source of capabilities) the role of the **manager** and the experience developed over time, in handling with these complexes issues, are determinants to the organizational success. A good definition of **manager** that we found is from the *Harvard Business School* in chapter "*Delegating with Confidence*" in the book "*Manager's Toolkit: The 13 skills Managers Need to Succeed"* (Harvard Business School, 2004): *"A manager is someone who gets results through other people."*

In the strict sense of governance, management includes the directors and managers who have the power and responsibility to make decisions and oversee an enterprise. In addition, the size

of management can range from one person in a small organization to hundreds or thousands of managers, in multinational companies. Also, in large organizations, the board of directors defines the policy which is then carried out by the *Chief Executive Officer*, or CEO. In fact, some scholars, such as Doz and Kosonen (2010) [S84], agree that in order to evaluate a company's current and future worth, the most important factors are the quality and experience of the **managers**.

In addition, Peter Drucker (1986), one of the most influential authors about this topic, has been described as "*the founder of modern management*", whose writings contributed to the philosophical and practical foundations of the modern business corporation. Drucker was also a leader in the development of management education, inventing the concept known as "management by objectives", a pragmatic approach for management. In fact, he stated that:

> *"Management is tasks. Management is a discipline. But management is also people. Every achievement of management is the achievement of a manager. Every failure is a failure of a manager. People manage rather than 'forces' or 'facts'. The vision, dedication, and integrity of managers determine whether there is management or mismanagement."*

However, Day (2000) argues that there is a need to clarify the difference between **managers** and **leaders** for the purposes of leadership development. He argues:

> *"Leadership development is defined as expanding the collective capacity of the organizational members to engage effectively in leadership roles and processes. Leadership roles refer to those that come with and without formal authority, whereas management development focuses on performance in formal managerial roles. Leadership processes are those that generally enable groups of people to work together in meaningful ways, whereas management processes are considered to be position- and organization-specific."* (p.582)

In this context emerges the relevance of the leadership in management science. According to Winston and Patterson (2006):

> *"A leader is one or more people who selects, equips, trains, and influences one or more follower(s) who have diverse gifts, abilities, and skills and focuses the follower(s) to the organization's mission and objectives causing the follower(s) to willingly and*

> *enthusiastically expend spiritual, emotional, and physical energy in a concerted coordinated effort to achieve the organizational mission and objectives."*

In other words, managers should be leaders and they need develop leaders into their teams, in order to help themselves to achieve better results in management. This issue become even more relevant in agile governance, when we will discuss the leader role in the emerging theory context (Section 4.2.3).

Based on what has been discussed above, we can infer "people" as a central element of management, as well as their ability to generate results, an its essential concern. Thus, in the remainder of this work, these key aspects will inspire us to consider "*people and their development*" as decisive driving force of change in the organizational context. However, the mission of this Section, which was minimally to present the term "management", ends here.

3.5.1 Governance and Management

As presented previously, **governance** is about "*sense* and *respond*", "*leadership* and *guidance*". Governance steers an organization toward a vision and ensures the day-to-day management is aligned with the organizations goals. It is about setting the right policy and sequences for ensuring things are done in a proper way. On the other hand, **management** is about doing those things (defined by governance) in a proper way.

In fact, one of the greater risks to a good organizational performance is ensuring that people are able to delineate their different responsibilities. In retrospect **governance** is the strategic task of the organization's goals, directions, limitations and accountability frameworks. Nevertheless, **management** is the allocation of resources and overseeing daily operations of the organizations.

In other words, while **governance** is focused on creation of a setting in which others can manage effectively, **management** is focused on use this setting to operating the things from a tactical point of view. Management also deploys processes to implement governance policies and works toward the strategic goals of the enterprise. Afterwards, the team or staff, then, participates in executing the processes.

Likewise, ACT Council of Social Service (2014) in Australia points out that one way to think about this is that *Governance* determines the "**What**?" - *What* the organization does and what it should become in the future. *Management* determines the "**How**?" - *How* the organization will reach those goals and aspirations.

In addition, when the set of structural and functional tasks related with governance and management, from several sources, such as (Drucker, 1986; Mitchell and Shortell, 2000; Smelser and Swedberg, 2005) is analyzed; and when those components are applied on a PDCA cycle (Deming, 1952), the harmonic and collaborative relationship between these areas gains visibility, such as depicted in **Figure 3.1**.

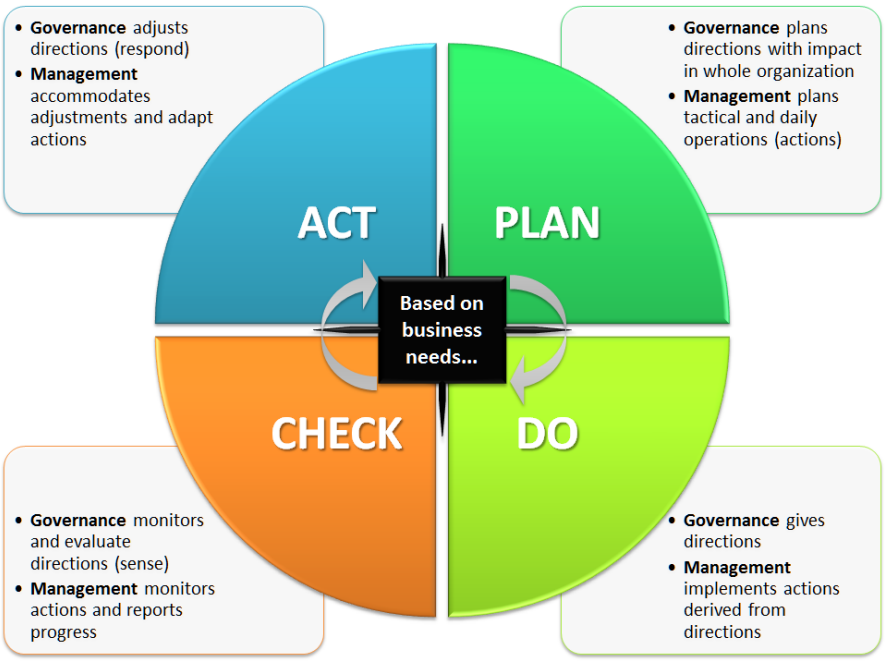


Figure 3.1 - **Components for the perfect partnership: Governance and Management. Source:** Own elaboration inspired by (Deming, 1952; Mitchell and Shortell, 2000; Moen and Norman, 2006).

Actually, as depicted by **Figure 3.1**, from the perspective of PLANNING:

- **Governance** determines the mission, strategic plan and appointment of the steering committee. Board of directors, executives and top management of the organization should participate actively.
- **Governance** sets and guards the moral tone (principles and ethics).
- **Governance** develops plans and policies that guide the appointment of staff and the delivery of value to organization through their services, products and projects.

- **Governance** sets the financial plan (budget) and funding plans.
- **Governance** identifies mechanisms for accountability.
- **Governance** defines a set of mechanisms to achieve and maintain the organization toward its vision and ensures the day-to-day management is aligned with the organizations goals.
- **Management** plans tactical and daily operations, derived from the Governance's mainstream.
- **Management** also applies its competencies and capabilities, to adjust the planning trajectory, when necessary, between what the strategy determines and what is possible at time.

At the same time, or on a sequence, from the perspective of DOING:

- **Governance** gives directions for actions.
- **Management** defines and implements plan, methods and techniques derived from the PLANNING stage outcomes, and those directions provided by Governance.
- **Management** implements improvement plans.

In complement, from the CHECKING perspective:

- **Governance** monitors the strategic progresses.
- **Governance** evaluates periodically the responsibilities and mechanisms implemented.
- **Governance** conducts periodical reviews of strategic outcomes.
- **Governance** suggests strategic improvement plans.
- **Management** monitors and report responsibilities and mechanisms implemented.
- **Management** monitors tactical and operational progresses.
- **Management** evaluates periodically the tactical results.

- **Management** suggests tactical and operational improvement plans.

Eventually, from the ACTING perspective:

- **Governance** sets strategic improvement plans.
- **Management** sets and implements tactical and operational improvement plans.

Furthermore, the ITIL v3 (Cartlidge et al., 2007; OGC, 2007a) and the COBIT 5 (ISACA, 2012) are the two most widespread and recognized frameworks related to IT governance. Moreover, both of them propose a wide spectrum of processes, activities, responsibilities and metrics to guide the management of IT environment.

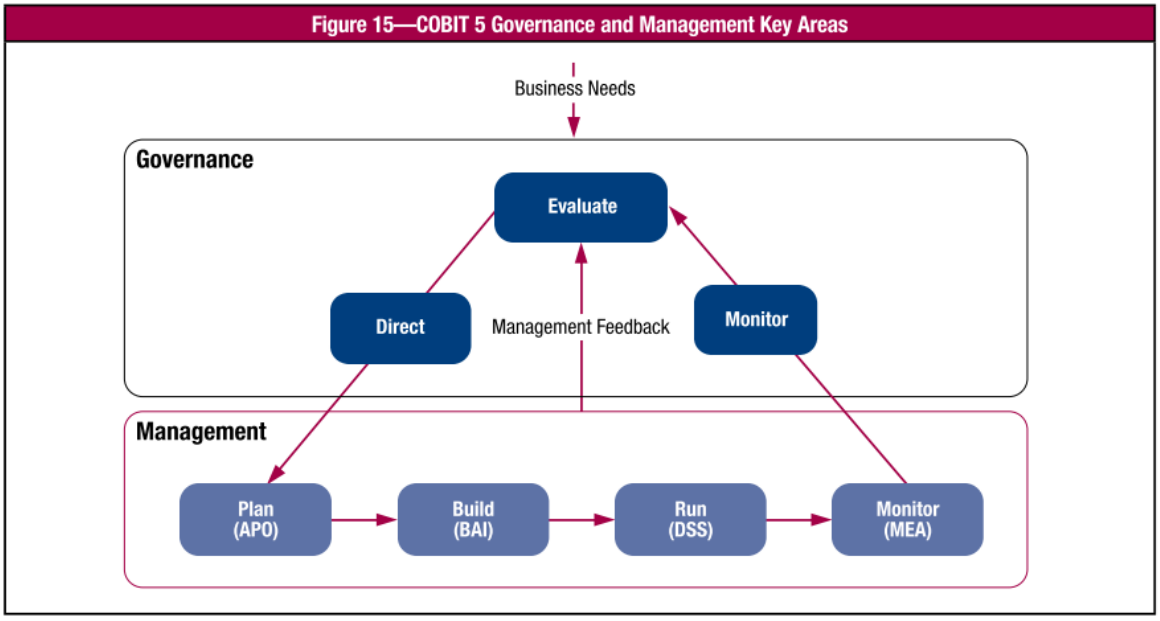


Figure 3.2 – COBIT 5: Governance and Management key areas. Source: (ISACA, 2012)**.**

In addition, the COBIT 5 framework dedicates one of their 5 principles to make a clear distinction between governance and management. According to ISACA (2012) these two disciplines encompass different types of activities, require different organizational structures and serve different purposes. For example, the COBIT 5 view on this key distinction between governance and management is: *"Governance ensures that stakeholder needs, conditions and options are evaluated to determine balanced, agreed-on enterprise objectives to be achieved; setting direction through prioritization and decision making; and monitoring performance and compliance against agreed-on direction and objectives".*

In fact, **Figure 3.2** of the COBIT 5 framework illustrates the mentioned difference and complementary approach between governance and management, as well as demonstrates to be very coherent with **Figure 3.1**, proposed previously by our own analysis.

Also, according the COBIT, in the most part of the enterprises, governance is the responsibility of the board of directors under the leadership of the chairperson (ISACA, 2012): *"Management plans, builds, runs and monitors activities in alignment with the direction set by the governance body to achieve the enterprise objectives".* In complement, management is the responsibility of the executive management under the leadership of the CEO.

Despite this, the COBIT 5 expresses that governance and management must work systematically and interconnected through enablers such as: goals and metrics, among other aspects. Thereby, governance and management must have operate together (harmonically), in their respective foci, in a complementary and collaborative way, as a perfect partnership, as can be seen in **Figure 3.3** and **Figure 3.4**. For instance, ITIL in its third version, presents a set of 26 management processes and five operational functions distributed in a lifecycle services five stages, such as portrayed by **Figure 3.3** (OGC, 2007a).

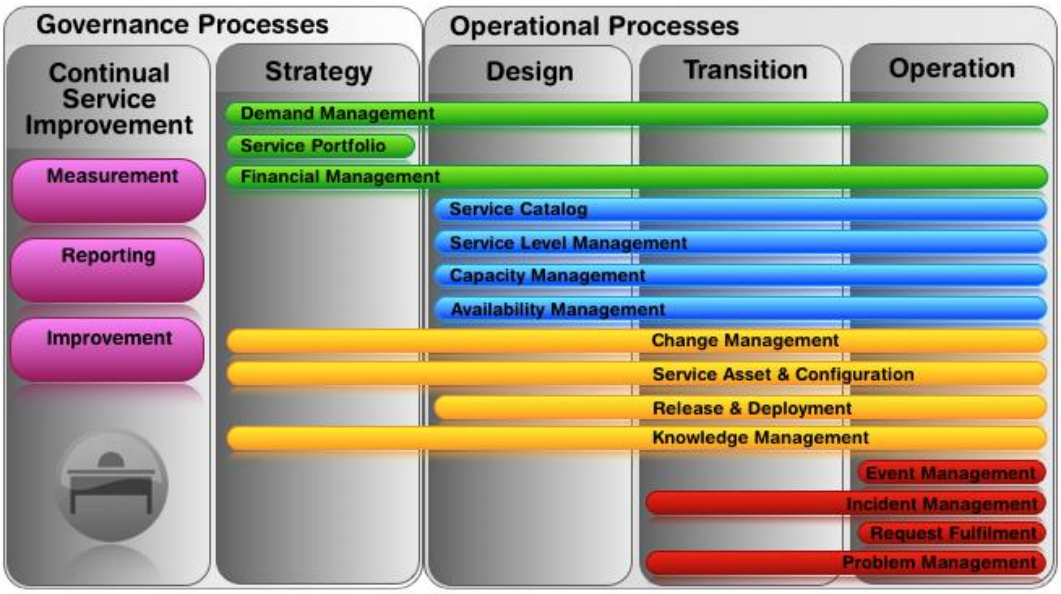


Figure 3.3 – ITIL v3 Service Lifecycle governance and operational elements. Source: (SERVAplex, 2012)**.**

On the other hand, the framework COBIT in its fifth version points out five governance processes and 32 management processes, such as depicted in **Figure 3.4** (ISACA, 2012).

In addition, Chulani et al. (2008) [S1] complements that in its dynamic dimension, *governance* establishes the measurement and control strategy, whereas *management* is concerned with the collecting and interpreting the actual measurement and making decisions based on them.

For example, *governance* determines who makes the decision about enterprise IT investments and *management* determines the actual amount and resources invested.

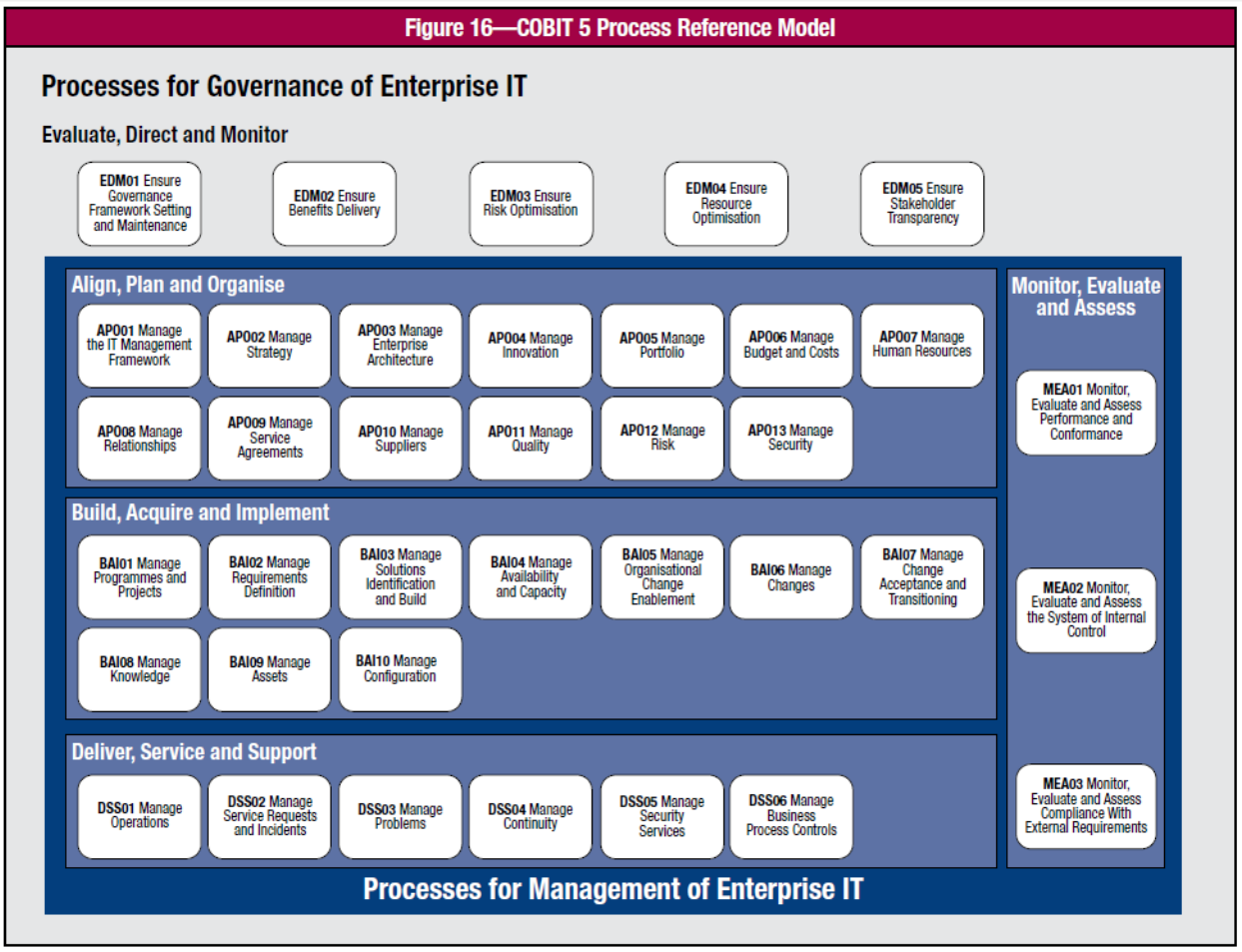


Figure 3.4 – COBIT 5 Process Reference Model. Source: (ISACA, 2012)**.**

In fact, *governance* starts at the senior executive level and extends via the *management* structure to the practitioner or operational level where projects are implemented and the changes occur. Chulani et al. (2008) [S1] add that the *governance* process starts with the senior executives assigning decision rights and authority and determining measurement and control policies. *Managers* allocate available resources and deploy effective processes to achieve the established goals. Depending on the size of the organization, a cascading effect of assigning decision rights and deploying processes may occur illustrating the fractal nature of *governance*.

Eventually, these evidences collected on the industry literature, points out to a collaborative, harmonic and coordinated work between governance and management to achieve the business results. In fact, this is an idea defended by this work.

3.6 The need to be agile

In order to keep the enterprise competitive in this increasingly complex and demanding global market, Thomas and Pham (2004) [S39] advocate that companies must discover innovative ways to manage their production operations effectively and efficiently. As highlighted by Wang, Lane and Conboy (2011) [S69], *lean thinking* has its origin in manufacturing and especially the Toyota Production System from the 1950s, and its primary focus is on the identification and elimination of waste from the process. The *concept of agility* was first coined in 1991, as indicated by Gong and Janssen (2010) [S4], as the result of a study of a future view of USA manufacturing which was believed to be vulnerable and beaten by competitors, describing the practices observed and considered as important aspects of manufacturing. Sun, Zhang, and Valota (2005) [S28] point out that, also in 1991, the *agile manufacturing paradigm* was introduced by Nagel (Nagel, 1991) as the means for industry to achieve or improve the ability of coping with continuous and unanticipated changes in their business environment and proactively capture opportunities from the turbulent business environment. This concept has since attracted significant amount of attention from both the academia and industry. The potential benefits of implementing it in companies were soon widely recognized by researchers and practitioners.

According to Tsourveloudis and Valavanis (2002), "**agility**" is more formally defined as: *"the ability of an enterprise to operate profitably in a rapidly changing and continuously fragmenting global market environment by producing high-quality, high-performance, customer-configured goods and services".*

In keeping with Kamoun (2007) [S13], enterprises have to bring a closer alignment between business processes and IT resources and reach the desired business agility and responsiveness to changing business requirements.

According to Nambiar (2009) [S30] agility was defined by Oleson (1998) as: *"the ability to respond with ease to unexpected but anticipated events ...the capability that allows for a response to be executed with ease".*

In fact, agility provides the organization with a competitive edge in today's world of global competition and cost-conscious consumer. Also, in line with Goldman et al. (1995), *traditionally agility* has been understood as the capability of an enterprise to operate in a ‘‘*competitive*

environment of continually, and unpredictably, changing costumer opportunities''. In other words, "*agility is the ability to thrive and prosper in an environment of constant and unpredictable change*".

In addition, agility has been defined simply as the ability to respond to unexpected change. It has also been defined as the comprehensive response to the business challenges of profiting from rapidly changing, continually fragmenting, global markets for high quality, high performance, customer configured goods and services (Goldman et al., 1995).

In this context, it is observed that more organizations are adopting the agile approach as a survival tactic in these economically turbulent times which in turn led to interesting views (Cummins, 2009). As a result, agility became an important business aspect, and according to Luftman et al. (1993), **business agility** is: *"the ability to change direction on the environment, and respond efficiently and effectively to that change".*

As highlighted by Luna et al. (2010) [S60] many authors such as (Cummins, 2009; Roosmalen and Hoppenbrouwers, 2008; Sloane et al., 2008), have said that in order to survive the voracity of the market, **business agility** is required.

Indeed, Goldman et al. (1995) add that agility is the ability to thrive and prosper in an environment of constant and unpredictable change, and is required not only to accommodate change but also uncertainty.

For instance, nowadays the customers' desire highly customized products tailored to their specifications at the lowest possible prices and the shortest possible time. Companies, in order to survive, have to not only improving their efficiencies by eliminating wastes in their processes but also must have the capability to introduce newer products with minimum design-to-market times. Agile enterprises have a competitive advantage due to their ability to quickly respond to customers' demands (Nambiar, 2009) [S30].

In other words, agility is a business-wide capability that embraces organizational structures, information systems, logistics processes and, in particular, mindsets. According to Christopher (2000) a key characteristic of an agile organization is flexibility. However, as stated by Ribeiro and Barata (2011) [S10], agility is more than being flexible. In keeping with Gong and Janssen (2010) [S4], regards flexibility as a predetermined response to predictable changes, while agility entails an innovative response to unpredictable changes.

In fact, has pointed by Nambiar (2009) [S30] flexibility and responsiveness are the hallmarks of an agile enterprise. In complement, at enterprise level agility has to be understood in a holistic perspective. Being agile is little different from being flexible. The latter often refers to the ability of producing a range of products (mostly predetermined) with multipurpose equipment. It is also different from being lean (producing without waste). Agility in this way begins with strategy, where the strategy to become agile and the strategy to exploit the agility must be considered, drawn and put as the baseline of the pace to competitiveness.

Along with, according to Ribeiro and Barata (2011) [S10], the concept of **lean manufacturing** emerged as a reaction of the oil crisis and the significant socio-economic changes in the 1950s–70s. They state that: *"A **lean manufacturing** system is one that meets high throughput or service demands with very little inventory, and with minimal waste. The most important idea behind lean manufacturing is avoiding waste, **'muda'**, which is the Japanese word for waste."*

After all, "**muda**"' is any human activity that absorbs resources but creates no value. Lean organizations claim they are more efficient because they only spend resources in activities that add value. There is, of course, the problem of identifying the value of an activity. Another aspect of lean manufacturing is the way the production line (shop floor) is organized. Shop floor workers are organized into teams with a team leader rather than a foreman, as occurred in mass production. The workers are polyvalent and able to execute the various tasks assigned to the team. This provides generally a greater sense of fulfilling in the workers since they are not confined to the repetitive execution of the same tasks as in mass production. Further, teams have the right to stop the assembly line, whenever they think it is necessary, as when repairing it. Workers are stimulated to participate with suggestions to improve the process.

Indeed, ***agility implies understanding change as a normal process and incorporating the ability to adapt and profit from it***. Agility covers different areas, from management to shop floor. It is a top-down enterprise-wide effort. The agile company needs to integrate design, engineering, and manufacturing with marketing and sales, which can only be achieved with the proper IT infrastructure.

According to Gallagher and Worrell (2007), designing and maintaining IT for enterprise agility is complicated when the competitiveness of the organization's products and services is dependent on an ability to respond to market changes at both the business unit and organizational levels. In fact, the same authors highlight that, for example, standardizing all

product design at the organizational level would restrict agility at the business unit level, by reducing the ability of business units to respond to local business conditions.

The word “agile” was used in association with “software process” for the first time in 1998 by Aoyama (1998), as stated by Dybå and Dingsøyr (2008). In 2001, ten years after the introduction of the agile manufacturing paradigm, was stated the *Manifesto for Agile Software Development* (Beck et al., 2001), bringing a similar approach to Software Industry.

Dybå and Dingsøyr (2008) posit that the Agile Methodologies have gained importance and add competitiveness and dynamism to the process of software development in the area of Software Engineering, through initiatives where the principles of communication and collaboration are crucial, as also stated in [S92] and (Dubinsky et al., 2008b). Moreover, Dubinsky and Kruchten [S71], [S74] highlight that Software Development Governance (SDG) has emerged in the last few years to deal with establishing the structures, policies, controls, and measurements for communication and for decision rights, to ensure the success of software development organizations.

Moreover, Kruchten (2011) [S92] define **agility** as:

> *“the ability of an organization to react to changes in its environment faster than the rate of these changes.”*

In fact, this definition uses the ultimate purpose or function of being agile for a business, unifying and standardizing agile and lean approaches as simply "agile", rather than defining agility by a labeled set of practices or by a set of properties defined in opposition to the agile manifesto approach (Beck et al., 2001). Due of this simplified and objective approach, this will be the definition of agile adopted for this work.

To tell the truth, we recognize that while agility is focused on react rapidly to changes, lean is focused on combat the wastages. Although those approaches sometimes may seem confrontational if analyzed in its essence, we believe that the rational balance between those approaches can result in a unified "agile" approach that can achieve a better result than if they were applied separately, in consonance with Wang, Conboy and Cawley (2012) [S165].

3.7 State of the art of Agile Governance

Agility at the business level requires Information Technology (IT) environment flexible and customizable, as well as effective and responsive governance in order to deliver value faster, better, and cheaper to the business. In order to understand better this context, we seek to investigate how the domain of agile governance has evolved, as well as to derive implications for research and practice.

Hence, we conducted a systematic literature review about the state of art of the agile governance up to and including 2013. This study was introduced in Section 2.4.1. Our search strategy identified 1992 studies in 10 databases, of which 167 had the potential to answer our research questions. We have organized the studies into four major groups: software engineering, enterprise, manufacturing and multidisciplinary; classifying them into 16 emerging categories. As a result, the review provides a convergent definition for agile governance, six meta-principles, and a map of findings organized by topic and classified by relevance and convergence. Details about those findings are available at APPENDIX II.

The found evidence lead us to believe that agile governance is a relatively new, wide and multidisciplinary area focused on organizational performance and competitiveness that needs to be more intensively studied. Eventually, we made improvements and additions to the methodological approach for systematic reviews and qualitative studies. These methodological improvements are detailed at APPENDIX I. The wording of this section and the coming sections of this chapter are mainly based on the review findings.

Specific details about the review and its findings are organized in specific Appendices, as follows: **APPENDIX I.1** -SLR: Sistematic Literature Review Protocol, **APPENDIX I.2** - SLR: Studies Included, **APPENDIX I.3** - SLR: Quality Assessment Form, **APPENDIX I.4** - SLR: Data Extraction Form, **APPENDIX I.5** - SLR: Overview of the Studies, **APPENDIX I.6** - SLR: Overview of Quality Assessment, **APPENDIX I.7** - SLR: Studies: Contributions, Focus, Sampling and Geography (Q1), **APPENDIX I.8** - SLR: Emerging Categories, Studies and Constructs (Q1), **APPENDIX II** - SLR: Emerging findings.

The description of the findings of our review and how they influenced the existing knowledge about agile governance until then will be discussed from this point in the following subsections.

3.7.1 Motivation and alignment

Recently, a proposal of **agile governance** has emerged. Qumer (2007) [S54] presents the **first definition of agile governance** we found, focused on Agile Software Development. In an article about controlling and monitoring of Product Software Companies, Cheng, Jansen and Remmers (2009) [S63] present the **second definition to agile governance** we found, focused on Software Development Governance (SDG). Additionally, Luna, Costa, Moura and Novaes (2010) [S60] proposed a **third definition of agile governance**, focused on IT governance, resulting from the wide application of adapted principles and values of *Agile Software Development Manifesto* to the conventional governance processes. In 2013, a **fourth definition for agile governance** was introduced by Luna, Kruchten and Moura [S150], as a result of perception of the multidisciplinary nature of the phenomena related to agile governance. All previously cited Agile Governance definitions are verbatim available in the **Table 3.3**.

Hence, the concept of agile governance is gaining attention and evolving over the time as a meaning that is increasingly making sense in different contexts. By way of illustration, Roosmalen and Hoppenbrouwers (2008) [S76] points out other benefits of an agile approach in the context of business can be identified, for example: improved time-to-market and increased speed of decision making, which ultimately reflects in increased organizational competitiveness.

Despite this, the **agile governance** seems a relatively new field of study. Also, agile governance seems to have a wide spectrum of interest for executives from any business area and IT professionals, by treating, in essence, aspects such as: organizational performance and competitiveness.

Agility at the business level demands *capabilities*[20], such as flexibility, responsiveness and adaptability, which should be applied in combination with governance capabilities, such as strategic alignment ability, steering skills and dexterity to perform control; in order to achieve effective and responsive sense of coordination across multiple business units, especially in competitive environments. Under this context, the IT is the link between the decision-making ability, the willingness strategic, and the competence to put into practice these tactics concretely.

[20] "The power or ability to do something." (OED, 2013)

In fact, the design and maintenance of the IT systems for enterprise agility can be a challenge when the products and services must be compliant with several regulatory aspects (often needing to be audited). However, the establishment of the necessary management instruments and governance mechanism to fulfill this mission passes by the application of models and frameworks that many times have no guidance details of how to implement and deploy them (such as ITIL and COBIT, among others), affecting the organizational competitiveness (Gerke and Ridley, 2009; Mendel, 2004).

3.7.2 Agile Governance: characterizing the approach

At this point, it is important differentiate the well-known (1) specific agile approach widely held on organizations, such as agile software development or agile manufacturing; from the (2) agile governance approach proposed by this work. While the former has its influence limited to a localized result, usually few stages of the value chain (Porter, 1985) of the organization. Our proposal introduces the application of agility upon the system responsible for sense, respond and coordinate the entire organizational body: the governance (or steering) system. **Figure 3.5** depicts the difference between those approaches, in order to facilitate understanding: on part (A) we use an analogy that illustrate the anatomy of an organization as an human body; meanwhile the part (B) relates those approaches to the value chain concept proposed by Porter (1985).

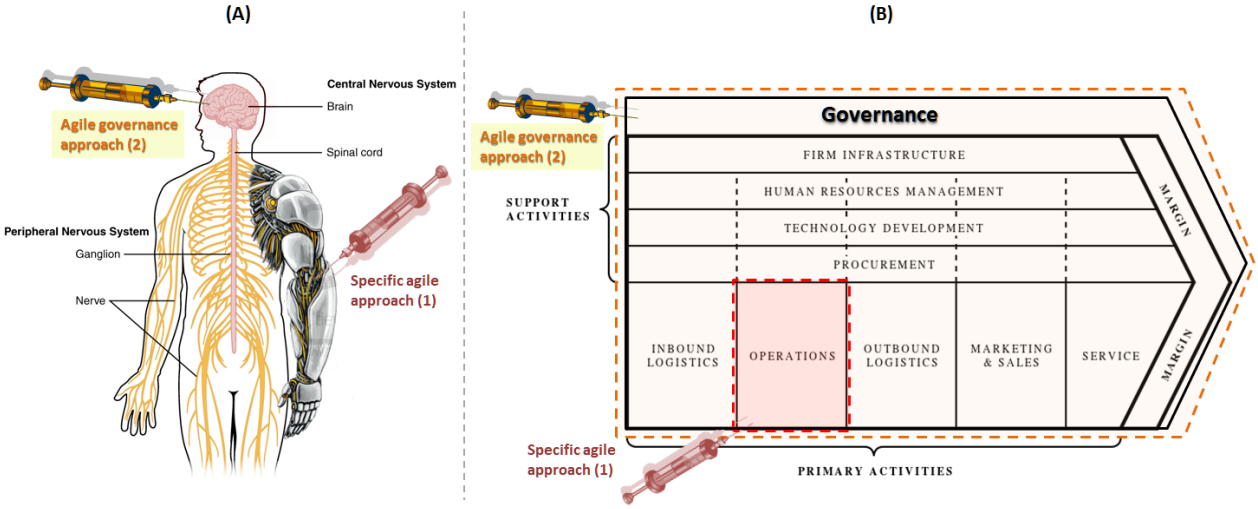


Figure 3.5 – Organization's anatomy: an analogy. Source: (Luna et al., 2014b).

In fact, most of the experiences and initiatives found by this work, in the academy and industry literature, were about the application of the agility paradigm in software development, manufacturing, logistics, projects, etc.

Doing an analogy through the comparison between of the organization's anatomy and the human body, when we look at **Figure 3.5.A** we can compare the **specific agile approach (1)** on the organization's anatomy, as an application of new materials or potentiating substances that improve the natural abilities of the organs, muscles and tissues, enabling a located better performance, such as: using "bionic" prostheses, having certain physiological functions augmented or enhanced by electronic equipment or chemical substances.

In fact, this approach allows that a subsystem of the organizations (organ, muscle or tissue) can "run faster", "carry more weight", but without explore the whole potential of the agile capabilities (substance or implant) because the other organs of the same body (entire system) did not receive the same treatment, limiting the overall body achievements.

In addition, anytime the performance of the "potentiated subsystem" can be limited by the performance of the subsystems which were not potentiated by the same approach: the weakest links. For instance, we can observe this kind of effect in a Software company that apply agile software development methodologies for their projects, but they do not apply the same approach in other stages (links) of their *value chain*[21] (see **Figure 3.5.B**), either in their primary activities, such as: support service, service operation, marketing and sales, etc.; or even their support activities, such as: billing, contracting, infrastructure, procurement, human resources management, etc. Or even in their relationship with customers and suppliers.

Moreover, it becomes increasingly difficult to the central nervous system (enterprise's governance system) to sense, coordinate and respond all the demands received from the components of the subsystems of the body, because it also was not potentiated by the same agile approach, do not developing the required awareness to do that. Including it may cause an overload on the components of the enterprise's body of governance. Both biologically and entrepreneurially (organizationally), this organizational context is not sustainable and it can generate fatigue e degeneration on the organs (subsystems) and their relationships sometime, if this unbalanced circumstance is maintained for a long term.

Many times an isolated use of the agile capabilities in specific business units, teams or projects, can bring incomplete benefits and debatable advantages, because the performance may not be

[21] We are addressing the value chain concept proposed by Porter (1985), which analysis looks at every step a business goes through, from raw materials to the eventual end-user. The goal is to deliver maximum value for the lesser possible total cost.

sustainable, whether the other sectors of the organization were not equally stimulated to participate under the same principles, values and practices.

Using this analogy, we can imply that the application of agile capabilities could have not a better sensitive point to be applied in whole enterprise's anatomy: enterprise's governance system, by means of an **agile governance approach (2)**. Indeed, we are talking about its central nervous system, where the strategies are defined, the decisions are made and the direction is adjusted according to the changes of reality. In fact, "true" *enterprise agility* or *business agility*, in all required levels, is about agility in the whole enterprise's value chain (each link or stage), and it could not be achieved whether the agile philosophy is not assimilated by the *Steering System* (organization's head).

Truth be told, when we look at the application of agility on governance it may seem like antagonist ideas (an *oxymoron*[22]) or counter intuitive. Nevertheless, if the enterprise's goal is to achieve the *true business agility*, it cannot be reached without commitment from all sectors of the organization, which in turn cannot be achieved without governance. Hence, the concept of *agile governance* makes sense and it is necessary. In the Sections that follow, we will dig into this issue gradually.

3.7.3 Summary of previous reviews

Based on the related work cited on previous Sections, we looked for a previous systematic review related with the topic in many domains as described below. In the **software industry**, according to Abrahamsson et al. (2002) there has been no systematic review about agile development methodologies found before 2002. After that, gradually, introductions about and overviews of agile software development are provided by a set of authors, such as (Abrahamsson et al., 2002), (Erickson et al., 2005) and (Dybå and Dingsøyr, 2008b). These set of publications portray the state of the art and practice about methods of agile software development, as well as learned lessons from application of such methods in software industry.

The systematic review on **agile software development** which has the recent highest annual citation rates, presenting the average over 120 citation by year as reported by Google Scholar (2013), was conducted by Dybå and Dingsøyr (2008) about empirical studies of agile software development up to and including 2005. As stated by them, the "*main implication for research is*

[22] "A figure of speech in which apparently contradictory terms appear in conjunction." (OED, 2013)

a need for more and better empirical studies of agile software development within a common research agenda" for researchers and practitioners.

Dybå and Dingsøyr (2008) point out some evidences about the application of agility beyond Software Engineering area, such as: agile manufacturing, lean development, new product development, interactive planning, maturing architectural design ideas and strategic management. These insights were very useful for our systematic review because they gave us some directions and helped us classify more accurately the findings of this research.

Wang, Lane, Conboy and Pikkarainen (2009) [S17] conducted a workshop called "Agile Research – A 7-Year Retrospective". This workshop, which aimed to investigate *"where the agile research goes"*, was based on an open discussion around past papers presented at the *International Conference on Agile Processes and eXtreme Programming in Software Engineering* (XP), identifying current gaps and areas for future research. From the sample of 161 papers published on this conference, they classified ten of them as related to the emerging area of **business agility**, which was pointed out as one of *six emerging trends* that must be explored and studied and points the direction for where agile research goes. Although this approach cannot be considered a systematic review, it presented an **agile research topic map** that influenced the findings treatment of our systematic review.

In the **manufacturing industry**, Ramaa et al. (2009) address the dearth of research on performance measurement systems and performance metrics of *supply chain network* by reviewing the contemporary literature, developing a systematic literature review. Their study lists more than 60 references for further study. They present four definitions for Performance Measurement of Supply Chain (PMSC), as well as a brief discussion about the evolution of this issue.

In the **IT governance** area, Qumer (2007) [S54] presents a summary of an exploratory review and analysis to identity the related concepts, key aspects and importance of IT governance, but he does not deepens the discussion. Correspondingly, Qumer proposes a conceptual "*agile responsibility, accountability and business value governance model*", for large agile software development environments. Likewise, Luna (2009) conducted an exploratory review about the agile governance, using four electronic databases, found 75 references, and trying to identify, catalog, classify, the principal initiatives and authors, as well as understand the relationship between the several approaches about the theme, up to and including July 2009. The results of

this work provided insights to propose a reference agile framework for implement and improve governance in organizations, called MAnGve. The MAnGve framework is focused in the deployment process, as a catalyzer, it accelerates the governance implementation.

Recently, Wang, Conboy and Cawley (2012) [S165] carried out an experience report analysis to provide a better understanding of **lean software development** approaches and how they are applied in agile software development. The authors *"have examined 30 experience reports published in past agile software conferences in which experiences of applying lean approaches in agile software development were reported*". The findings of the study enrich our understanding of how lean can be applied in agile software development. The authors have identified *six types of lean application* in these experience reports and categorized them in a more systemic way: i) non-purposeful combination of agile and lean; ii) agile within, lean out-reach; iii) lean facilitating agile adoption; iv) lean within agile; v) from agile to lean; and, vi) synchronizing agile and lean.

However, we did not find systematic reviews in other areas of knowledge related with the combined application of **agile** *capabilities* on **governance** *capabilities*. In other words, apparently, no systematic review about agile governance has been done yet. Therefore, there are no common understandings about the challenges that we must deal with, when examining the effectiveness of agile capabilities on governance issues, available for organizations and practitioners.

3.7.4 Synopsis

Unfortunately, our research did not identify any previous systematic review about agile governance. Due that, this work can be considered the first systematic review about the agile governance, in which we found 167 studies (see APPENDIX I.2) related directly or indirectly with this domain.

We will now present and discuss our results. The set of evidences found was heterogeneous, leading the researchers to organize these studies into four major thematic groups: (1) software engineering, (2) enterprise, (3) manufacturing and (4) multidisciplinary.

Following, we will describe the characteristics of the studies; the research methods adopted, and evaluate the quality of the studies. Later, we will introduce the studies contained in the

four groups mentioned above. In turn, we will address the findings about the state of art of agile governance. After that, the upcoming subsections discuss the strength of evidence of these findings, followed by the implications of the findings for research and practice and emerging contributions. Eventually, we discourse about the limitations of this systematic review.

3.7.5 Overview of studies

In line with the **type of reference**, or the type of the channel of publication, our review found 105 studies (62.9%) that were published through *conferences*, 59 (35.3%) studies that were published in scientific *journals*, and three studies (1.8%) was published in *magazines*. APPENDIX II.4 will discuss this issue in more details.

Concerning to the **nature of the research**: 101 studies (60.5%) were developed by researchers (in the *academy*) and 66 (39.5%) were carried out by practitioners or had the *industry* focus. The **Figure 3.6** presents the publication profile along the time, from the selected studies, grouped by year. Our review found no studies related with the issues of agile governance *prior to 1996*. In the same figure we can see three curves: the profile of publication for *academy* (A) and *industry* (I), as well as the *total of publication* (T) distributed along the years. Considering the phenomena as a nascent area we can approximate the data from T for a linear *trend line* (L), which equation is expressed in **Figure 3.6**, presenting a coefficient of determination (R^2= 0.8029). Based on this information, we can observe a *steady growth* of studies related with agile governance, reinforcing the idea of this area is in formation. In spite of the timeline publications can be expressed by a trend line, we cannot perform long-term forecasts because shall happen likely loss of linearity resulting from a significant event in the evolution of the phenomena in study.

Furthermore, **Figure 3.6** denotes a rapid growth process about total number of publications (T) found by this review after 2001, nearly doubling in the range 2001-2006, almost tripling in 2007. We believe that the behavior of the "T curve" agrees with the idea that this is a recent field of study in developing, as well as we rely on a trend of rapid growth of the publications related with this domain for the coming years. Regarding to the profile of publication for Academy (A) and Industry (I), in spite of the result expected for the industry profile to be usually try to experiment, test or/and apply the knowledge developed by academy, on this case

we can see a little different behavior: we can observe that the Industry has followed the profile of publication of the Academy without significant lag, implying agile governance as a topic of practical and immediate applicability. The agile software development methods are phenomena that have a similar behavior in this aspect.

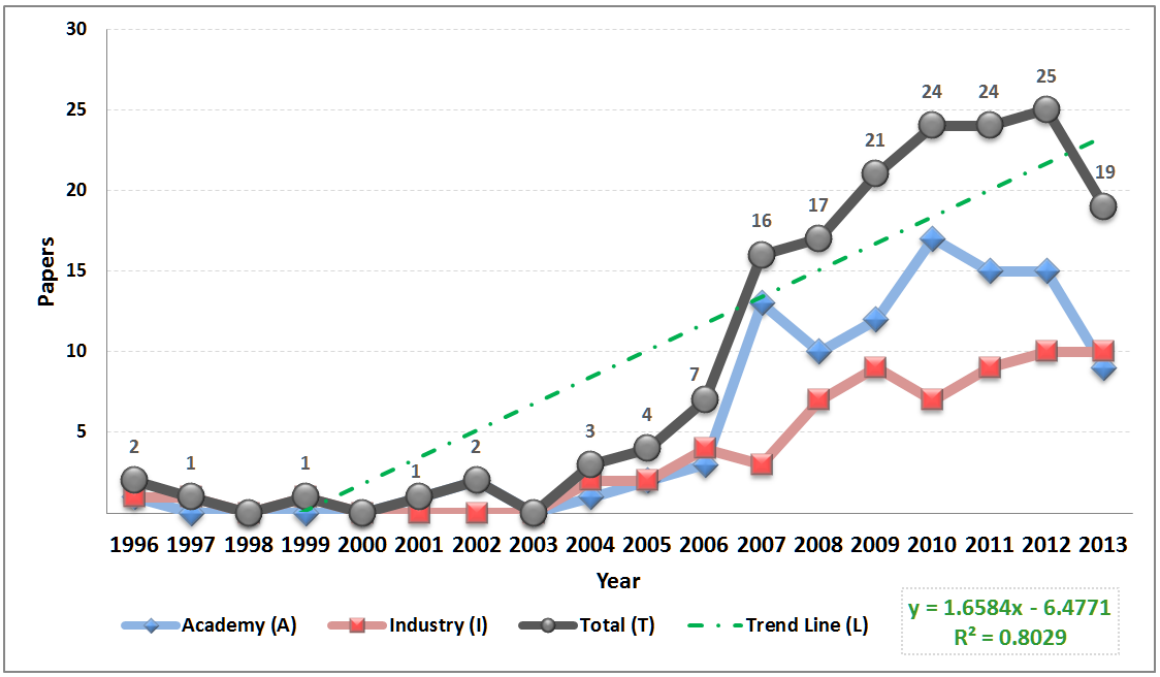


Figure 3.6 – Review's Timeline: studies by year. Source: (Luna et al., 2014b).

Each publication was further classified based on the nature of the study (**study type)**, trying to answer the follow question: "*Was the study reported empirical research or whether it was merely a 'lessons learned' report based on expert opinion?*". Details how this analysis was carried out is given in the APPENDIX I.4, as well as the details about classification of each paper is depicted in APPENDIX I.5. Only 36 papers (21.6%) could be considered empirical[23] studies. The result from this analysis is listed in Table II.1.

3.7.6 Emerging Groups and Categories

The 167 studies were classified according the approach of constant comparison applied in qualitative data analysis (Corbin and Strauss, 2008), following a bottom-up strategy: firstly trying identify emergent category, after trying to relate and group them, in a sequence of refinement cycles. Always as possible this classification was carried out according the papers' authors point of view. In other words, when the authors were explicit about the category, their own classification was considered.

[23] When the study demonstrated materiality and a coherent description about the methods applied (with consistent scientific rigor), conveying that it was based on evidence by means of experimentation or observation.

Table 3.2 – Emerging (exclusive) Groups and Categories. Source: (Luna et al., 2014b).

Code	Description	Studies	%	Characteristic	Focus
G1	**Software Engineering**	**62**	**37.2%**	**Application of agile capabilities upon governance capabilities on Software Engineering**	**Software production**
GASD	Governance for Agile Software Development	23	13.8%	Application of governance capabilities on Agile Software Development	Agile Software Development
SOAG	SOA Governance	20	12.0%	Application of agile capabilities upon governance capabilities on Service-oriented Architecture	SOA
SDG	Software Development Governance	17	10.2%	Application of agile capabilities upon governance capabilities on Software Engineering	Software Development
SPIA	Software Process Improvement (SPI) Agility	2	1.2%	Application of agile capabilities upon governance capabilities on Software Process Improvement	SPI
G2	**Enterprise**	**61**	**36.6%**	**Application of agile capabilities upon governance capabilities on Business Management or Public Administration**	**Enterprise as a whole**
EA	Enterprise Architecture	24	14.4%	Application of agile capabilities upon governance capabilities on Enterprise Architecture	EA
AE	Agile Enterprise	16	9.6%	Application of agile capabilities upon governance capabilities on Enterprise's *modus operandi* (Business and Public Administration)	Organizational agility and responsiveness
e-Gov	e-Government	10	6.0%	Application of agile capabilities upon governance capabilities related to solutions for electronic Government	e-Government
APA	Agile Public Administration	9	5.4%	Application of agile capabilities upon governance capabilities on Public Administration	Government
l-Gov	Lean-Government	2	1.2%	Application of lean capabilities upon governance capabilities on solutions for electronic Government	Government
G3	**Manufacturing**	**21**	**12.6%**	**Application of agile capabilities upon governance capabilities on Manufacturing**	**Manufacturing industry**
AM	Agile Manufacturing	12	7.2%	Application of agile capabilities upon governance capabilities on manufacturing process	Manufacturing
ASC	Agile Supply Chain	8	4.8%	Application of agile capabilities upon governance capabilities on Supply Chain	Logistic
LM	Lean Manufacturing	1	0.6%	Application of lean capabilities upon governance capabilities on Manufacturing	Manufacturing
G4	**Multidisciplinary**	**23**	**13.8%**	**Application of agile capabilities upon governance capabilities on many areas of knowledge**	**Holistic and wide approach**
AITG	Agile IT Governance	7	4.2%	Application of agile capabilities on IT Governance	IT Governance
APPG	Agile Projects and Portfolio Governance	6	3.6%	Application of agile capabilities upon governance capabilities on Projects and Portfolio Management	Project
SG	Service Governance	5	3.0%	Application of agile capabilities upon governance capabilities on Service Management	Service
LG	Lean Governance	5	3.0%	Application of lean capabilities upon governance capabilities on IT Governance	IT Governance
	Total	**167**	**100%**	**-**	**-**

As a matter of fact, the authors were explicit about the category classification in 75 (44.9%) from the 167 papers selected. In 92 cases (55.1%), the category of the study was not explicit, and we had to compare the characteristics (content, objective and approach) of the paper with the categories previously identified to proceed the study classification.

In other cases, the authors were not explicit about the category as well as the paper did not fit with any category previously identified: in these cases we had to propose a new category based on the paper characteristics. There were cases where the authors mentioned more than one category; in those cases we tried to identify which category was predominant, more consistent (or dense) in the paper content, to proceed with the study classification.

After the first cycle of classification for the studies, we started a classification refinement procedure, trying to review and confirm the classification from each cycle. In each cycle of this refinement procedure, each researcher revised the classification defined by the others. All discordances were treated by discussion that involved all the researchers involved at this stage that had to reach a consensus. Any change in the classification, passed by the same procedure of revision and cross-checking among team researchers.

The identification of emergent categories started with 34 original categories. After four refinement cycles, these categories were reduced to 16, sorted in four major groups, as depicted on **Table 3.2**. The information about which study belongs to each category is presented in APPENDIX I.5.

In the **Software Engineering group (G1)** we classified categories associated with application of agile capabilities upon governance capabilities on Software Engineering, and focus on software production. This was the group with major representativeness, accounting 37.2% of all studies selected by this review.

In the second most representative major group (36.6%) from this review, the **Enterprise group (G2)**, we assorted categories associated with application of agile capabilities upon governance capabilities on Business Management or Public Administration, and focus on the enterprise as a whole.

In the third one, the **Manufacturing group (G3)**, we classified categories associated with application of agile capabilities upon governance capabilities on Manufacturing, and focus on manufacturing industry.

Finally, in the **Holistic (or Multidisciplinary) group (G4)** we sorted categories associated with application of agile capabilities upon governance capabilities on aspects that permeate many areas of knowledge, and aiming attention at holistic and wide approach.

Nonetheless, these groups are not isolated from each other. In truth, they have a strong relationship among each other, such as depicted in **Figure 3.7**. Additionally, this figure is the result from a second *non-exclusive classification* about the relationship between the study characteristics and the four major groups, starting from the original and exclusive classification from the **Table 3.2**. In other words, adopting the same approach of revision and cross-checking applied in the exclusive classification, tags were applied for each study, trying to identify its relationship with the major groups, according the study characteristics.

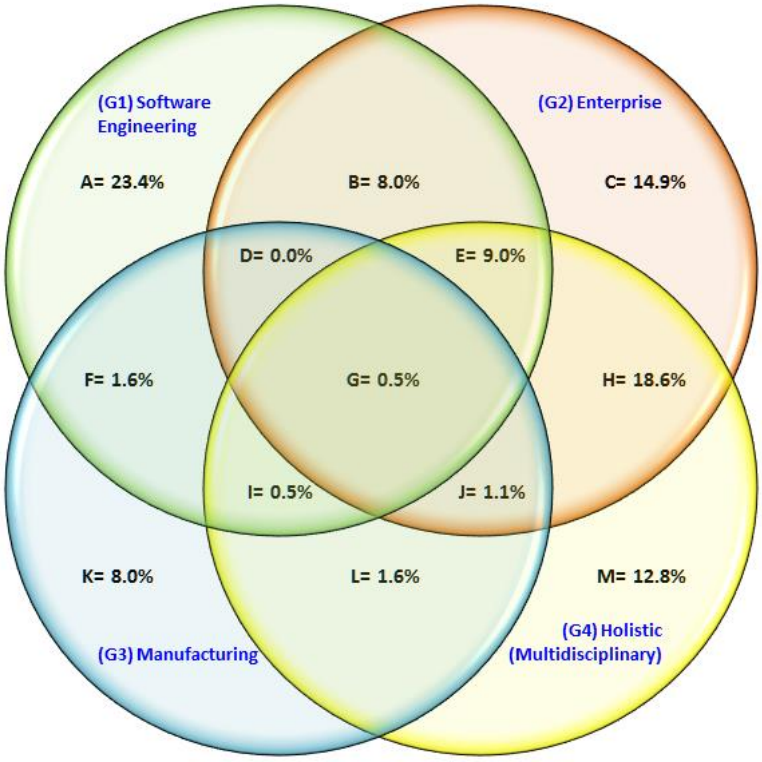


Figure 3.7 – Emerging Relationship (Non-Exclusive) between the Major Groups. Source: (Luna et al., 2014b).

In the **G1** were sorted four emerging categories related with Software Engineering. In the category **Governance for Agile Software Development (GASD)** we classified 23 studies (13.8%) related with application of governance capabilities on Agile Software Development, and focus on this same topic. In **SOA Governance (SOAG)** we sorted 20 studies (12%) related with application of agile capabilities upon governance capabilities on Service-oriented Architecture, and focus on this specific architectural style. Similarly, in **Software Development Governance (SDG)** we classified 17 studies (10.2%) related with application of agile capabilities upon governance capabilities on Software Engineering, and focus on software development

governance. In **Software Process Improvement (SPI) Agility (SPIA)** we assorted two studies (1.2%) related with application of agile capabilities upon governance capabilities on Software Process Improvement, and focus on SPI.

Likewise, in the **G2** we arranged five emerging categories related with whole enterprise approach. In **Enterprise Architecture (EA)** we sorted 24 studies (14.4%) related with application of agile capabilities upon governance capabilities on Enterprise Architecture, and focus on EA. At the same time, in **Agile Enterprise (AE)** we classified 16 studies (9.6%) related with application of agile capabilities upon governance capabilities on Enterprise's *modus operandi* (Business and Public Administration), and focus on organizational agility and responsiveness. In **e-Government (e-Gov)** category we sorted ten studies (6%) associated with application of agile capabilities upon governance capabilities related to solutions for electronic Government, and focus on e-government. In **Agile Public Administration (APA)** we classified nine studies (5.4%) have connection with application of agile capabilities upon governance capabilities on Public Administration, and focus on this subject. Finally, in **Lean-Government (l-Gov)** we classified two studies (1.2%) related with application of lean capabilities upon governance capabilities on solutions for electronic Government, and focus on government.

In **G3** we organized three categories related with manufacturing industry. In **Agile Manufacturing (AM)** we classified 12 studies (7.2%) related with application of agile capabilities upon governance capabilities on manufacturing process, and focus on this theme. In **Agile Supply Chain (ASC)** we sorted eight studies (4.8%) related with application of agile capabilities upon governance capabilities on Supply Chain, and focus on this subject. Eventually, in **Lean Manufacturing (LM)** we classified one study (0.6%) related with application of lean capabilities upon governance capabilities on Manufacturing, and focus on this issue.

G4 grouped four categories whose applicability and approach are multidisciplinary, wide or holistic. For instance, in **Agile IT Governance (AITG)** we classified seven studies (4.2%) related with application of agile capabilities on IT Governance, and focus on this topic. In **Agile Projects and Portfolio Governance (APPG)** we sorted six studies (3.6%) related with application of agile capabilities upon governance capabilities on Projects and Portfolio Management, and focus on this matter. In **Service Governance (SG)** category we classified five studies (3%) related with application of agile capabilities upon governance capabilities on Service Management, and focus on this theme. Similarly, in **Lean Governance (LG)** we grouped five studies (3%) related

with application of lean capabilities upon governance capabilities on IT Governance, and focus on this subject.

Additionally, **Figure 3.8** depicts each category, group and relationship perceived among them. Every category is represented by a network node using the same color adopted by **Figure 3.7** for the group, as well as each group is rendered as a node in black.

Analyzing the data from **Table 3.2** and the description for each category, we could still try group some categories by focus (or core orientation). Under this approach the **G1** will not be affected. Nonetheless, on **G2**, the category **Lean-Government (l-Gov)** could be grouped in **e-Government (e-Gov)** category, due the second one might be a specific approach of the first one, and they have the same focus: application of lean or agile approaches in government, raising its representativeness for 12 studies (7.2%). Similarly, on **G3**, the category **Lean Manufacturing (LM)** may be grouped in the category **Agile Manufacturing (AM)**, because they have the same focus: manufacturing, changing its representativeness for 13 studies (7.8%). In like manner, on **G4**, the category **Lean Governance (LG)** might be grouped in **Agile IT Governance (AITG)**, due they have the same focus: IT governance, raising its representativeness for 12 studies (7.2%). Nevertheless, we preferred keep the original classification given by authors for final categorization of findings.

Regardless of the groups and categories identified by this review, in spite of the G1 has the most part of the isolated papers (23.4% from the 167 papers have no relationship with other group), **Figure 3.7** denotes the relationship is denser between the G2 and G4 (sectors E $\cup$ G $\cup$ H $\cup$ J), due 29.3% from the selected papers are in these intersection regions. This finding implies the holistic nature from G4 and the wide approach of G2, inasmuch as the focus of the latter is the enterprise as a whole.

Comparing the values between the **Table 3.2** and **Figure 3.7** is possible to identify a changing in the sort of representativeness of each group to this review. As a matter of fact, when we add the contribution of each sector from each group (even considering each intersection more than once, because some of them belongs to more than one group), the non-exclusive representativeness became: G2 (52%) > G4 (44%) > G1 (43%) > G3 (13%).

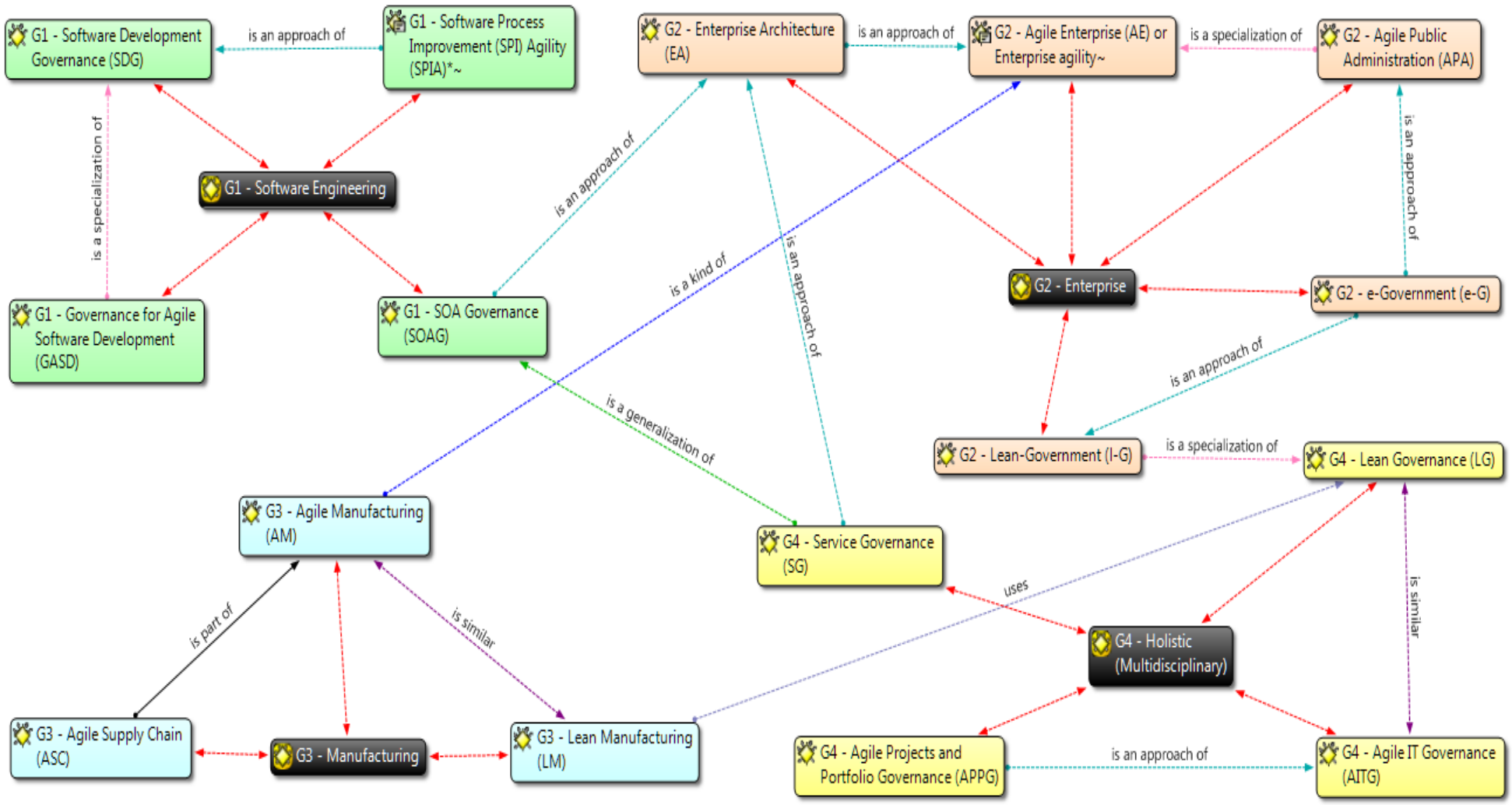


Figure 3.8 – Mapping the relationships for categories and groups. Source: (Luna et al., 2014b).

This situation probably occurs due some studies originally classified exclusively according **Table 3.2**, on the non-exclusive analysis carried out to generate **Figure 3.7**, were classified also in other groups, in consonance with its characteristics. This phenomenon did not happen with the same intensity with the papers of G1 and G3, because their categories are more specific and have a better defined scope.

3.7.7 Genesis and evolution

We also develop the timeline depicted in **Figure 3.9**, under the lens of the evidences found, in order to identify relevant aspects in the formation of agile governance field, as well as understand its *genesis* and *evolution.*

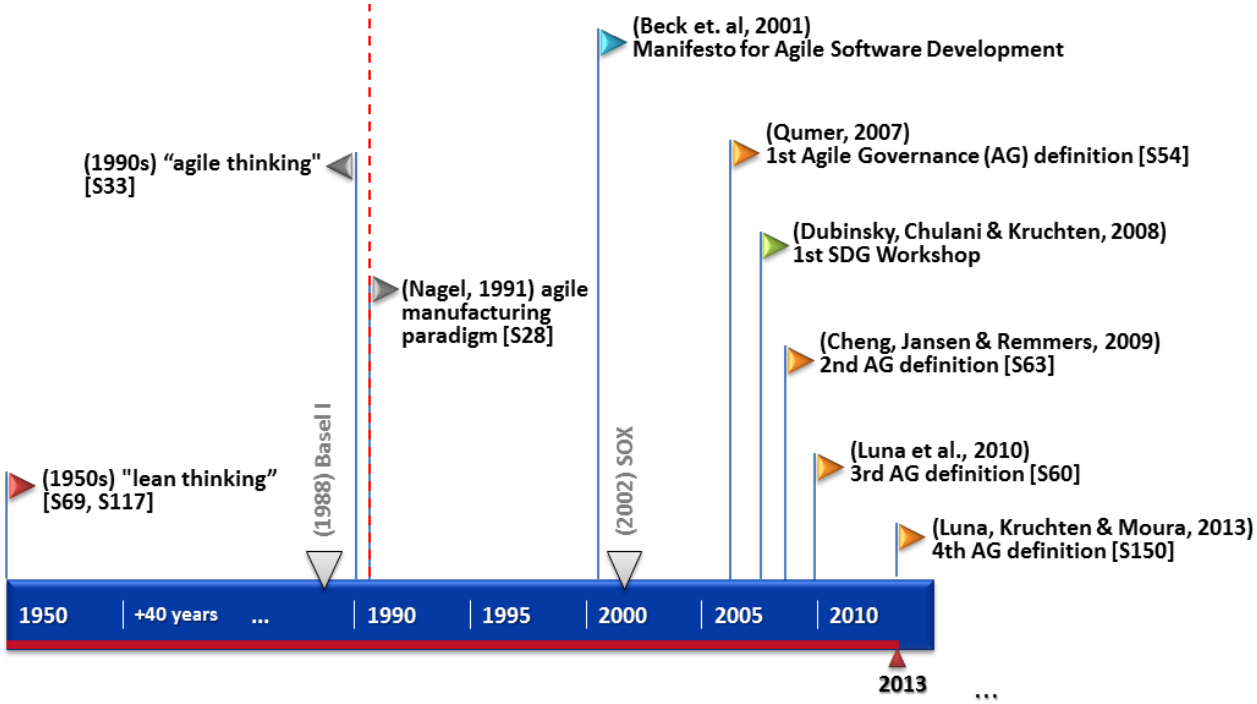


Figure 3.9 – Agile Governance genesis timeline. Source: (Luna et al., 2014b).

In retrospect, this review regained the recent history of agile governance that is intimately related with the "lean thinking" begun in the 1950s on Japanese industry [S117], [S69]. For a better understanding of the temporal relationship between these facts we plotted some marks that highlight the increasing of importance of global governance issues in the business, such as: the Basel I, the first of the three most important regulatory marks in bank market (Bank for International Settlements, 2010), as well as Sarbanes Oxley Act, the most important regulatory mark in stock market (US Congress, 2002). Our review found evidences that *agile philosophy* began at manufacturing industry (Nagel, 1991) ten years before the Manifesto for Agile

Software Development (Beck et al., 2001). In reality, the "*agility thinking*" has entered in the literature in the early 1990s [S33]. However, as stated by Sun et al. [S28] just after the introduction of the agile manufacturing paradigm by Nagel (1991), this concept began to attract significant attention from both the academy and industry.

Table 3.3 – Agile Governance definitions. Source: (Luna et al., 2014b).

Authors, Year	Focus	AG Definition
Qumer (2007) [S54]	Agile Software Development	*"an integrated agile governance involves lightweight, collaborative, communication-oriented, economical and evolving effective accountability framework, controls, processes, structures to maximize agile business value, by the strategic alignment of business-agile goals, performance and risk management"*
Cheng, Jansen and Remmers (2009) [S63]	Software Development Governance	*"the accountability and responsibility of management, adopting agile software development methods, and establishing measurement and control mechanisms in an agile environment".*
Luna, Costa, Moura and Novaes (2010) [S60]	IT Governance	*"is the process of defining and implementing the IT infrastructure that provides support to strategic business objectives of the organization, which is jointly owned by IT and the various business units and instructed to direct all involved in obtaining competitive differential strategic through the values and principles of the Agile Software Development Manifesto* (Beck et al., 2001)
Luna, Kruchten and Moura (2013) [S150]	Multidisciplinary	*"the 'means' by which strategic competitive advantages ought to be achieved and improved on the organizational environment, under an agile approach in order to deliver faster, better, and cheaper value to the business."*

A good evidence to understand the genesis and evolution of the agile governance phenomena is analyzing how the concept employed to describe it has been evolved over the time. Our review found only five[24] studies in which were encountered agile governance definitions, those studies and the verbatim definitions are depicted in **Table 3.3**. Chronologically, in 2007 agile governance was first conceptualized on **Agile Software Development** context. In this meantime, in 2008, was carried out the first **Workshop about Software Development Governance (SDG)**, led by Dubinsky, Chulani and Kruchten (Dubinsky et al., 2008a), as a landmark of the moment when this topic reached recognized significance in Software Engineering. Looking at the **Table 3.3** we can realize that the agile governance definition gradually had expanded its focus for **Software Development Governance (SDG)** in 2009, then to **IT Governance** in 2010, and reaching a **multidisciplinary** approach in 2013. This behavior is coherent as a domain that is taking shape, where the authors start to realize its amplitude and the relationships among the many contexts where the phenomena manifest themselves, broadly and holistically faceted and they try to cover their multidisciplinary scope.

[24] The study [S75] cites the same definition from [S54].

Furthermore, **Figure 3.6** denotes a rapid growth process about total number of publications (T) found by this review after 2001, nearly doubling in the range 2001-2006, almost tripling in 2007. We believe that the behavior of the "T curve" agrees with the idea that this is a recent field of study in developing, as well as we rely on a trend of rapid growth of the publications related with this domain for the coming years. Regarding to the profile of publication for Academy (A) and Industry (I), we can observe that the Industry has followed the profile of publication of the Academy without significant lag, implying agile governance as a topic of practical and immediate applicability. The agile software development methods are phenomena that have a similar behavior in this aspect.

In spite of Software Engineering researchers and practitioners having a most relevant historical mark of the *agile movement* the Manifesto for Agile Development (Beck et al., 2001), our review found four studies early than 2001, with impact in other areas, which we cite chronologically: (1) Jin and Stough (1996) [S25] tries to overcome the lack in the meso-level analysis of "agility" by providing the *concept of agile city*, as well as discusses the policy implications of regional learning infrastructure and analyzes the impact of information, telecommunication and transportation on region economic development; (2) Seabright and Delacroix (1996) [S113] explore the concept of the *minimalist organization* as the antithesis of the bureaucratic form, in terms of its structural slightness and, through the example of Alcoholics Anonymous (A.A.); (3) Sharifi, Barclay and Gough (1997) [S33] discuss the *agile manufacturing as a new paradigm*, presents the UK manufacturing in this relation and the developed model for achieving agility; and, (4) Jones, Medlen, Merlo, Robertson and Shepherdson (1999) [S117] discusses the *application of lean principles* on BT (British Telecom), and describes some of the *lean tools and techniques* that are being used to transform BT in a lean enterprise.

3.7.8 Who uses it?

Based on findings of the review, we elaborate the **Table II.8**, available at **APPENDIX II.7**, as a sample of application (use) of agile governance, by scholars and practitioners, to illustrate the occurrences of its phenomena in different circumstances, in a globalized context.

In addition, we produced a map to synthesize application of agile governance around the world, based on the sample disclosed in **Table II.8**. Indeed, we realize applications of agile governance

(manifestation of its phenomena) with presence in three out of the five continents of the globe, as depicted in **Figure 3.10**.

Although this finding is out of the scope of our review published in (Luna et al., 2014b), we add in **Figure 3.10** recent experiences related to agile governance implementation in Brazil*. We found these experiences by snowball approach from the studies selected from our review findings, and further exploratory literature review, in the following publications: (Luna, 2011a, 2011b, 2009; Luna et al., 2014a, 2011).

Figure 3.10 – Mapping Agile Governance application. Source: (Luna et al., 2014b).

3.7.9 Much to be done

Despite many applications of agile governance have been found in this research, our findings, supported by the results presented in the previous Sections, point out the agile governance paradigm as a nascent area, lacking of consensus about concepts, patterns perceptions and direction. For instance, some group of authors use different concepts to express the same meaning, such as *Governance for Agile Software Development* (GASD) and *Software*

Development Governance (SDG), where the supposed difference between these concepts is that SDG could be applied in cases not using agile methods, while GASD would be restricted to agile methods, but both represent the effort to bring some governance mechanisms, responsibilities and control to software development projects. Under this vision SDG would encompass GASD. See **Figure 3.8** for further information. Or even, *Agile Governance for Service Oriented Architectures* (AGSOA) and *SOA Governance* (SOAG) in which the difference is even more difficult to discern, since due both concepts seek the establishment of structures, processes, policies and metrics appropriate to ensure the adoption, implementation, operation and evolution of a Service-Oriented Architecture aligned with business objectives and compliant with laws, regulations and best practices. Thus, from our point of view this review considers the same meaning for both. In the same line, we found the concepts of *Responsive Supply Chain* (RSC) and *Agile Supply Chain* (ASC), where the designations convey an idea of a different meaning, but when we go deeper, the authors are talking about the same thing: agility in supply chain.

In fact some candidate categories show up, as new ones, but when we dig into a little more we realize that those candidate were nothing more than specific approaches or specializations of categories previously identified. For instance: i) *Software Delivery Economic Governance* as an specific approach for Governance for Agile Software Development (GASD); ii) *Software Ecosystem (SECO) governance* as an specific approach for Software Development Governance (SDG); iii) *Business Intelligence (BI) agility governance* as an specific approach for Agile Enterprise.

In other cases, authors use the same concept (or term) to express different meanings. The best example of this situation is the agile governance definition itself. Our review found four different definitions published, but pointing out distinct points of view (see the following Section): being the first three definitions an attempt to delimit the scope of the phenomenon of interest by each author, as well as the fourth definition already an effort to extend the definition to fit to the broad phenomena in study. Another example is the understanding of "organizational agility", which has different components (flexibility, responsiveness, adaptability, etc.) in line with different authors. For instance, Roberts and Grover (2012) [S152] present a table with 15 different definitions for organizational agility and almost 50 key concepts derived from them.

In other words, based on the results of this review, the agile governance paradigm is an area in formation that has no achieved progress in terms of maturity, and needs initiatives which can give it direction and impulse. Analyzing the contribution of this research, from this point of view, this systematic review can be seen as a positive initiative towards giving *governance* to research and practice in this area. These evidences just reinforce this work as a starting point in give some direction and insights to help the development of this field.

The evidences found by this review lead us to realize the **urgent need for development of ontology for the agile governance paradigm**, as "*an explicit formal specifications of the terms in the domain and relations among them*" (Gruber, 1993), organizing and relating the concepts, synonyms and adequate terms to express the ideas in a clear, straight and objective way.

If on one hand, there are a set of principles, practices and values from subjacent areas (such as software engineering, manufacturing, government and business management) useful to apply in agile governance context. On the other hand, **these set of constructs are not organized and systematized for direct and immediate application**: they need be *translated* and *adapted* for each context. Truly, the available knowledge has to be *suitable* for the broad context of this domain, and our review did not found a guide, model or framework that can help to apply this knowledge in a systematic and adaptive manner. We believe that all those set of knowledge should be organized, connected and systematized in some kind of *conceptual framework* or *theory* (Bordage, 2009). Indeed, those evidences reinforce the need and meaning of the work developed by this thesis.

3.7.10 Agile Governance: phenomena characterization

The studies that handle over the adoption and introduction of agile methods on governance capabilities are still at an initial stage. Many of them were presented as a set of good intentions, but without a scientific rigor, which compromises their credibility and applicability. On the other hand, the big picture depicted by all of them do not give a unified view of ongoing practice, but offers a straightforward picture of experience and multiple fragmented findings. These issues is potentiate when we address aspects of agility in governance matters, a young and nascent area is **eight** years old, considering the publication of the first definition of agile governance by Qumer in 2007 [S54].

By means of the analysis of the publication timeline of **Figure 3.6** we can realize two stages whereby the agile governance phenomena recently passed: (1) **the period until 2006:** in which we can see weak signals of agile governance as phenomena in formation expressed by few and intermittent publications; and, (2) **the period after 2006**: when the phenomena starting to take shape, with the first few published definitions, some categories emerging, the start of a language's construction, though still with many noises, distortions and ambiguities. As a consequence, we can imply that the **next great event on those phenomena** will be related with the *alignment of that language* to allow an adequate communication among the scholars and practitioners in an effective way. This episode will support the academy and industry to communicate and understand the phenomenon more clearly, and consequently admit achieving the necessary *fluency* in this area of knowledge in order to conduct it to a new baseline, accelerating its development.

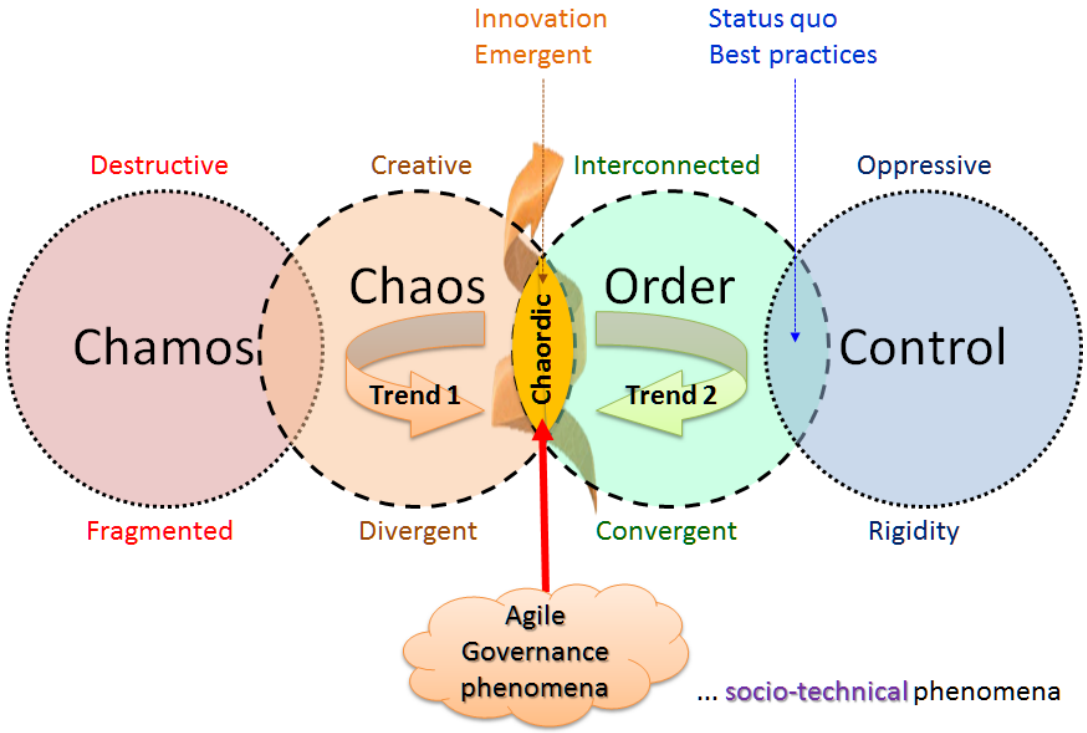


Figure 3.11 – Positioning the agile governance phenomena. Source: (Luna et al., 2014b).

Concerning to positioning of the phenomena, we can imply the agile governance as socio-technical phenomena positioned in a *chaordic* range between the innovation and emergent practices from agile (and lean) philosophy and the *status quo* of the best practices employed and demanded by the governance issues. The **Figure 3.11** depicts this phenomena's positioning proposal. The socio-technical nature of agile governance is substantiated due we are handling with the understanding of the intersections between technical and social aspects: considering people as agents of change in organizations, in contexts where technology is a key element.

Actually, the *chaordic* philosophy was proposed by Dee Hock, the founder and CEO emeritus of VISA credit card association (Hock, 2005) as "*a system of organization that blends characteristics of chaos and order*" (Hock, 1999), as an harmonious and fertile business environment, whereas the duality of coexistence between chaos and order ends up becoming a propitious habitat for learning, transformation, growing, creativity and innovation.

In this context, agile governance inherits chaotic elements from the agile paradigm in which fit the agile and lean capabilities, whereas acquires ordering elements from the governance paradigm, including legal and regulatory aspects. This approach demystifies the discussion mentioned at the introduction that suggests agility and governance as alleged antagonistic ideas. At the same time, it gives impulse for the consolidation of this concept as a creative and innovative balance between chaos and order, levering business achievements beyond the command-and-control conventional model.

In a complementary point of view, we can identify two *overall phenomena's trend movements*, in the agile governance paradigm, those are represented in **Figure 3.11**, based on the categories depicted in the **Table 3.2**: **(Trend 1)** mostly the categories related to G1 and G3 groups, *develop efforts to bring governance practices for their core issues* (respectively: Software Engineering and Manufacturing), leveraging existing agile culture in their environments; on the other hand, **(Trend 2)** mainly the categories comprehended in the G2 and G4 groups, *promote the endeavor of apply agile capabilities with governance capabilities for achieve better results in their core issues* (correspondingly: Enterprise and broad approach).

Although, these movements may seem contradictories, due they point out different (and apparently antagonist) directions into the same phenomena; those must be observed only as a point of beginning, due to the reality experienced in each context, to achieve the same results: apply agile and governance capabilities in combination. In other words, they are actually "*spin convergent*" (in a spiral movement), because the resulting vector of these two forces will reach the same result: unifying, adapting and accommodating particular components and specific issues in each area of application, to deliver value faster, better, and cheaper to the business.

3.7.11 Agile governance: a broad concept, meta-principles and meta-values

During the synthesis and refinement process of the review's findings, our perception and sensibility were shaped by the wealth of detail found about agile governance in the different areas of specialization identified, which derived the grouping of the categories in four major groups (see Section 3.7.6).

As a result, the evidence suggested that agile governance is a domain with set of open issues for study. Hence, in order to help researchers and practitioners to start to raise a unified view about this paradigm, this work propose a first step which can give direction and impulse to this domain.

The following emerging patterns and insights try to capture the evidences that were gathered with respect to the effective uses, shortcomings and trends about agile governance seeking to address the starting points with the view to help the development of this field.

The emerging evidence of this review lead us to believe that ***agile governance*** **can be** ***broad*** **and** ***holistically*** **defined**, as:

> *"is the ability[25] of human societies to sense, adapt and respond rapidly and sustainably to changes in its environment, by means of the coordinated combination of agile and lean capabilities with governance capabilities, in order to deliver value[26] faster, better, and cheaper to their core business."*

When we mentioned the term "**human societies"**, we try to encompass any kind of organizations, such as: companies in any industry, non-profit institutions, as well as governments in any level or conjunction (cities, provinces, countries, or even governments associations, e.g. The United Nations).

In turn, "**core business**" is the *raison d'être* of any organization, the cause of its existence. When the organization identifies its customers and recognizes which kind of benefit or value (by means of products and services) they are delivering to customers in order to achieve its institutional mission, they are addressing their core business. As a matter of fact, this concept

[25] "A natural or *acquired* skill or talent."(TFD, 2013).

[26] "An informal term that includes all forms of value that determine the health and well-being of the firm in the long run." (BD, 2013)

can be applied for any kind of organization, for instance: in case of a **company** may be the target activity to achieve profit, for a **NGO**[27] might be a variety of service and humanitarian functions, concerning to **governments** should be initiatives to accomplish the welfare of its citizens.

Gradually, *business agility* has become an expression that is not restricted to the universe of for-profit organizations. In consonance with the proposed definition, we distill a *new definition* to **business agility** as:

> *"the ability to deliver value faster, better, and cheaper to the core business".*

This new agile governance definition is being presented in order to be this comprehensive enough to cover all areas identified by this research, at the same time that it is still specific enough to be useful and applicable in each of these contexts, avoiding being another definition disconnected from the holistic nature of this wide field of study.

In spite of many of scholars can criticize the absent of the "process" concept on the aforementioned definition, we would anticipate in saying that agile governance is related much more to behavior and practice than anything else. Even because processes and procedures are already well established in governance context, and they "need to be followed", many of them needing to be audited (ISACA, 2012), or regulated by laws (US Congress, 2002), or else certified as international standards [S90].

At this point we would like to clarify that agile governance do not come replace the conventional models, frameworks and methods, such as ITIL (Mendel, 2004), COBIT (Gerke and Ridley, 2009), among others. Our proposal is just come shed a fresh look about governance, bringing enablers elements from agile philosophy to extend it for a more resilient and flexible paradigm. Actually, all knowledge relevant and useful existing related to governance topic have to be organized in some kind of dynamic repository which we will denominate conceptually of ***Governance Body of Knowledge (GBOK)***.

The GBOK should be organized systematically, fluidly and flexibly, according the pertinence relationship existing between: global governance, public governance, corporate governance, IT governance and other types of governance. Likewise, the GBOK should be structured by

[27] "A non-governmental organization (NGO) is any non-profit, voluntary citizens' group which is organized on a local, national or international level." (NGO GLOBAL NETWORK, 2014)

categories and dimensions and also contain processes, procedures, laws, regulatory aspects, as well as all sort of models, frameworks and methods already well-established and relevant related to the governance topic, such as: ITIL, COBIT, ISO 20000, ISO 27000 family, SOX, Basel Accords (Bank for International Settlements, 2010; Gerke and Ridley, 2009; Mendel, 2004; US Congress, 2002).

Moreover, the GBOK does not end in the models cited in this work or known at the time of this publication. In fact, it must be complemented, organized, and must have a scope and boundaries better defined in future works. Regardless this, the GBOK should be updated dynamically, in a continuous way. Despite some of GBOK components being proprietary models, the agile governance community should use the same policies and mechanisms adopted by some open-source projects to maintain the consistency and cohesion of the elements that belong to the GBOK, such as the *modus operandi* employed by Linux community [S1], for example.

At the same time, the synthesis of our findings when combined with the approach of agile methods on governance issues lead us to propose the following six **meta-principles** for agile governance, in order to guide future researches and, especially, to drive the practices:

1. **Good enough governance:** "*The level of governance must always be adapted according to the organizational context*". The level of governance required to achieve business agility must be balanced, and adjusted when needed, taking into account the particular conditions, and timing[28] of each organization. This meta-principle should lead the practitioners and researchers to reflect and consider the constraints experienced by each organization, without jeopardize the regulatory aspects or market rules. In other words, it can be accomplished respecting the particularities of each environment. For instance, something that is good for an organization can be too much for other, at least on a specific time frame. The question remains: is it worth paying for this "extra"? Taking for example the COBIT 5 framework (ISACA, 2012), which has 37 processes, and 17 enterprise goals. Shall these processes and goals be applied in any cases? In any kind of organizations?

2. **Business-driven:** "*The business must be the reason for every decision and action*". Decisions of any nature, in any organization instance, must be driven by and for the business. In other words, all decisions in any business unit, from entire organization (including its conjunctions

[28] "The selecting of the best time for doing or saying something in order to achieve the desired effect." (TFD, 2013)

and specific sectors) must be made taking into account the business strategy. People have to think each decision, design and approach to satisfy business requirements and priorities. Teams should create a broad culture that can influence the collective behavior in whole enterprise, in order to give rise to a cohesive organizational awareness. As a result of the alignment between the business layer and the governance layer, the connections among each unit of the entire organization, may work as a symbiotic relationship. This leads the organization to increase flexibility and to reduce the turnaround times when the business demands quick adapting of the infrastructure to its needs.

3. **Human focused:** "*People must feel valued and incentivized to participate creatively*". People have to be valued as a key element of change and the driving force in organizations, as well as they must be encouraged to contribute creatively to the business aims. In organizations there are people who perform, control and decide about the processes, in so far there must be leaders that aim to create value in the company by means of getting the best from people, motivating them strategically, to obtain the need engagement to the business. Nonetheless, mostly the prevailing methods and tools of governance still are concentrated on structures and processes. The necessity to understand people as an essential and creative component of the structures and processes is a *critical success factor* for governance initiatives. At the same time, the creation of effective mechanisms to incentive and support the relationship, communication and collaboration among people is imperative.

4. **Based on quick wins:** "*The quick wins have to be celebrated and used to get more impulse and results*". The quick wins achieved by team must be celebrated with the same intensity and seriousness with which the problems are addressed and solved, as well as its impulse must be used consciously to get more results. The quick wins seek an accumulation of small impulses which, together in the same direction, are reflected in the medium and long term great acceleration to the enterprise. This evolution must be continuously monitored and adjusted. The maturity achieved by the team reflects on "less jerky movements", less breakage and waste, as well as greater coordination between the parties involved (people, business units, etc.). The "positive energy" coming from these victories must be used consciously in the feedback and motivation to the team to continue development of the governance initiatives and, therefore, should be valued.

5. **Systematic and Adaptive approach:** "*The teams must develop the intrinsic ability to systematically handle change*". They should adopt a systematic and adaptive approach (adjusting the direction in line with the moment experienced by the organization). The teams and business units should seek to work as organisms adaptive rather than predictive ones. In other words, they should consider the change as natural component of the business environment, trying to adapt themselves to new factors arising from the development of their environments, as well as the business needs, rather than try to analyze previously all that can happen during each time box.

6. **Simple design and continuous refinement:** "*Teams must deliver fast, and must be always improving*." That is to say, they must choose always the simpler and feasible alternative to the solutions design, one that can be improved with the least possible waste at the earliest opportunity. The idea is to adopt simple design and to improve it as soon as possible, instead of a slow start, trying to establish a balance between the agile and lean approach. The architecture of the solutions should always be focused on streamlining between the desired results and the resources currently available. In other words, it is better to do something simple that generate results immediately, and pay a little more to improve it at the first opportunity (by means of a possible rework), than doing something complicated with a high cost of time and other resources, and end up losing the timing of the change in the business.

In fact, in these meta-principles, "*team*" is a generic word that can be applied for several complementary connotations in organizational context, such as: technical people, business people, and even the steering committee. Besides, the adoption of the Greek prefix "meta" to characterize them is due to our having designed these principles to provide a way of thinking across the disciplines that compose the agile governance phenomena, trying to cover their broad nature. Also we should clarify that the these meta-principles were shaped under the lens of the principles analysis method proposed by Séguin et al. (2012), properly adapted to the phenomena in study in this review. In other words, regarding to these meta-principles: (1) they are worded in a prescriptive manner in order to guide action; (2) they are not directly associated with, or rise from, a technology, a method, or a technique, nor they are a specific activity; (3) they do not state a comprise (or a mix) or trade-off between two actions or concepts; (4) they refer to concepts related with agile governance paradigm, some of them found in this review; and (5) they can be verified in its consequences and by experiments.

In order to demonstrate the application of these individual criteria analysis, we can take as example the third meta-principle: "*people must feel valued and incentivized to participate creatively*". In line with Séguin et al. (2012), we can imply: (1) retained: the principle is expressed in a prescriptive manner, clearly conveying its practical consequences; (2) retained: the utility or applicability of it is not associated to any technology, method, or technique, nor specific activity; (3) retained: the meta-principle does not propose an exchange of one thing in return for another, nor the relinquishment of one benefit or advantage for another, its essence is "people as an appreciative *critical success factor*"; (4) retained: we can find some *constructs* broadly used in agile governance, such as: *lack of appreciation of people in governance processes* as cited in [S11], [S72], [S99] (see 0 and APPENDIX II.6); and, (5) retained: we can check if this meta-principle is going on organization, by means of, for instance, an organizational climate survey.

We believe to achieve better results, teams should use those meta-principles with the support of a set of meta-values that even can help them to differentiate the conventional approach to governance from the agile governance approach. In order to do that we develop, following the same approach adopted for the meta-principles and inspired by the format adopted by Manifesto for Agile Software Development (Beck et al., 2001), a set of meta-values to fulfil this mission. Through this work we have come to value the meta-values from the column A of the **Table 3.4**.

Table 3.4 – Agile governance meta-values. Source: (Luna et al., 2015).

ID	(A) Agile Governance	(B) Conventional Governance
1	It is more about **behavior** and **practice**... than...	...**process** and **procedures**.
2	It is more about achieve **sustainability** and **competitiveness**... than...	...be **audited** and be **compliant**.
3	It is more about **transparency** and **people's engagement** to the business... than...	...**monitoring** and **controlling**.
4	It is much more about **sense**, **adapt** and **respond** ... than...	...follow a **plan.**

That is, while we recognize the value in the items on the right (column B), we value the items on the left more (column A).

3.7.12 Implications for research and practice

Several inferences for research and practice can be derived from our systematic review. A detailed discussion about this topic is available at APPENDIX II.9. In short, for **research**, this review demonstrates a clear necessity for studies with more scientific rigor and further empirical studies, in order to reach a deeper comprehension of agile governance. Our review confirms that agile governance present state of theory and research evidently *nascent*, and has a wide spectrum of interest for executives from any business area, professionals, researchers and practitioners by treating, in essence, aspects such as: organizational performance and competitiveness, as well as it can be verified by the categories and major groups that emerged from these research findings (see Section 3.7.6).

As discussed in Section 3.7.9, the evidences found lead us to realize the **urgent need for development of ontology for the agile governance paradigm** (Gruber, 1993), as well as the entire set of knowledge identified should be organized, connected and systematized in some kind of *conceptual framework* or *theory* (Bordage, 2009). Moreover, the **shortcomings** and **trends** identified in 0 and APPENDIX II.6, point out some direction for this domain research. Likewise, the results discussed in APPENDIX II.3 suggest that **any author who develops an objective work directed to this area he or she can become relevant rapidly**.

3.8 Closing remarks

This Chapter started characterizing the main concepts related to this research, and their relation: governance in its many scopes (Sections 3.2, 3.3 and 3.4), management (Section 3.5) and business agility (Section 3.6). Then, the Section 3.7 and its subsections have described, in short, a scenario about state of the art of agile governance, as a result from the systematic literature review carried out to understand better the related phenomena.

The theoretical background, related works, and review's findings presented in this Chapter, give to the reader a wide perception about the phenomena under study, their characterization and related contexts. This understanding is essential for the following Chapters, confirming the relevance of the ongoing research, as well as providing findings, as building blocks, to theory development. The next Chapter will describe the emerging theory, the building process based on Dubin's method and its main components, its development and its application.

Chapter

4

4. The Agile Governance Theory: development

This chapter aims to present the descriptive research and its consequent operation that generated the theory proposed by this thesis.

4.1 Introduction

Our analysis has resulted in the construction of the theory of *Agile Governance*, or the *Agile Governance Theory* (AGT), i.e., a theory for analyzing, and describing what the phenomenon in study is, classifying and characterizing their main constructs and categories and how they are relate to each other.

The presentation of Agile Governance Theory is organized as follows:

i. **Section 4.2** is a top-level summary of the theory and introduces a context for comprehension of the following Sections.
ii. **Section 4.3** is a characterization of the conceptual framework of the theory, as a result of the application of the four first steps of the Dubin's method. This conceptualization includes developing the theory's units, laws of interaction, system states, and boundaries.
iii. **Section 4.4** describes the operationalization, confirmation/disconfirmation (and application) of the theory following the four last steps of the Dubin's method. This operationalization entails developing the theory's propositions, empirical indicators, hypotheses, and research to test the theory.
iv. **Section 4.5** analyzes the system created by the emerging theory discussing its application, behavior, usefulness and consequences using the theoretical lens of Dubin (1978, 1976) and disciplined imagination of Weick (1989).
v. **Section 4.6** proposes a set of guidelines on how to put the emerging theory into practice, allowing an iterative and incremental development of the organizational context in theory assimilation and its effective implementation.
vi. **Section 4.7** discusses motivation for theory use, and how the reader can adapt the emerging theory to his or her own organization.

To afford a better understanding about the terms adopted in this work, we also have provided a glossary in **0**.

4.2 Overview

The agile governance phenomena emerge in the context of organizational environment, driving people to apply ***agile capabilities*** upon ***governance capabilities*** to provide ***business agility***. The predominant concern of them is to ***deliver value*** faster, better and cheaper to the business in ***sustainable cycles***. On the organizational context, governance is the keystone to create the necessary ***engagement*** of all units of the organization, attaining greater ***enterprise agility*** and supporting its ***overall strategy***.

Figure 4.1 depicts the theory's scope, data analysis and data synthesis, in order to give an overview about the steps and the products generated during this theory building research.

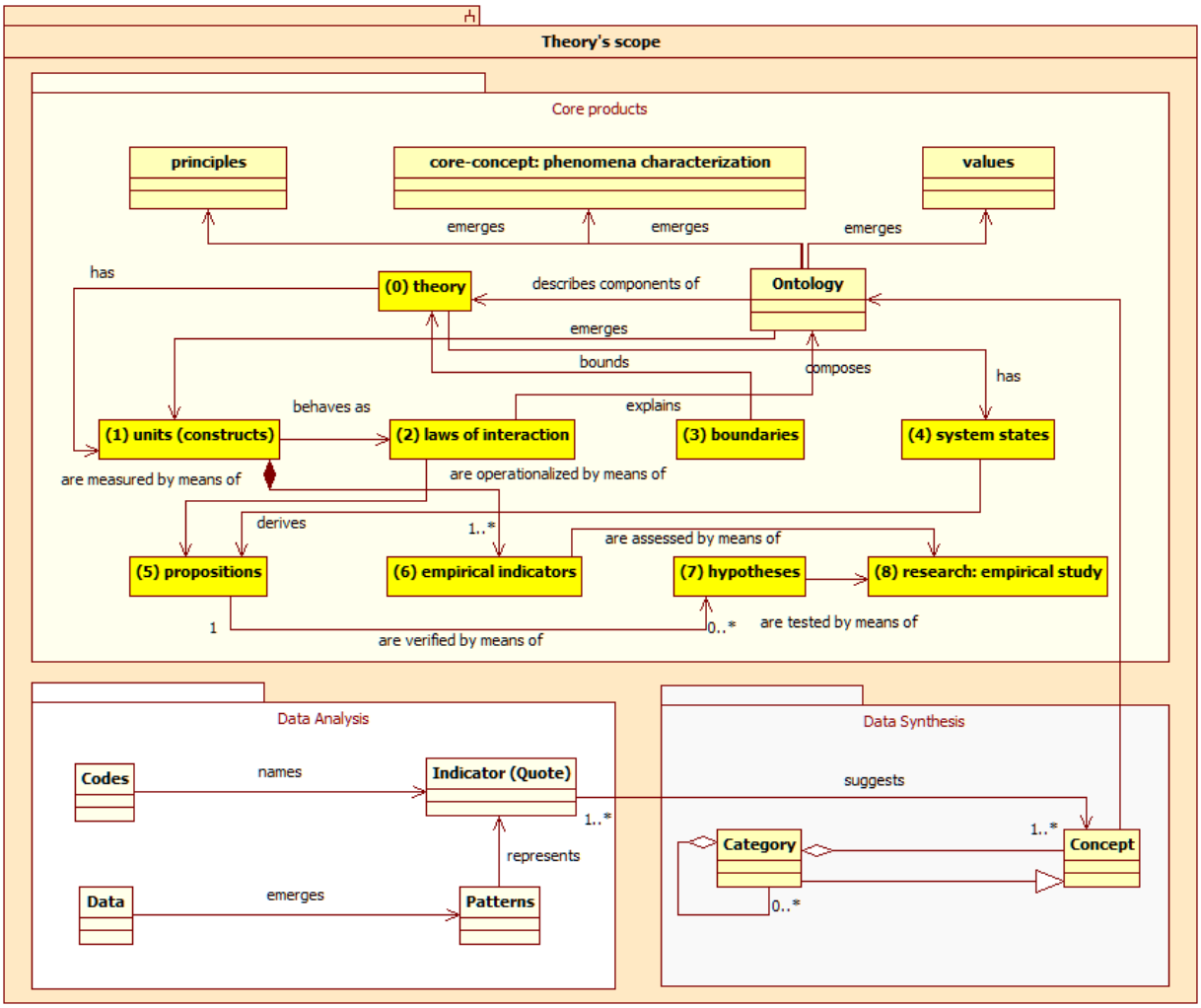


Figure 4.1 – Theory's scope: core products, data analysis and data synthesis. Source: Inspired on (Adolph, 2013; Evermann and Wand, 2005; Gruber, 1993; X. Li, 2007).

4.2.1 Usefulness and audience

In fact, adopting a pragmatic philosophical perspective, we could not avoid carrying out a practical and objective approach. Thus, we believe people should use the Agile Governance theory to understand their organizational context, identifying the effects of the factors from the external environment that generate disturbances in internal environment, as well as the moderators factors that can retard their advances, in order to be able to improve the ***organizational competitiveness*** (upgrading the ability to sense and respond to changes in competitive environments) and refine the ***organizational sustainability*** (working on the root cause for eliminating or mitigating the moderators factors).

4.2.2 Foundational Premises of the Theory

The development of the theory is based on three premises. These premises are core to the foundation and meaning of the theory.

1. The first premise is about the position of agile governance as chaordic and socio-technical phenomena, which was discussed in details at Section 3.7.10 (Agile Governance: phenomena characterization).
2. The second premise characterizes agile governance approach, highlighting the differential between the application of agile approach on governance capabilities, and the well-established agile specific approaches, such as agile software development (for instance). This characterization was done in Section 3.7.2 (Agile Governance: characterizing the approach), by means of elaborating an analogy about Organization's anatomy.
3. Finally, the third premise is the definition of agile governance as a broad concept and its meta-principles, and meta-values proposed by the Section 3.7.11 (Agile governance: a broad concept, meta-principles).

4.2.3 Important considerations about the role of: steering committee, executives, managers and leaders

During the synthesis and refinement process of the research findings, our perception and sensibility were shaped by the wealth of detail found about agile governance in the different areas of specialization identified, and formatting the perception of what can make a difference in its application in the real-world. Then we realized the preponderant importance of the both concepts “team’s spirit” and “leadership”. It is about how these concepts fit with the emerging theory that we will discuss briefly in this Section, as a prologue of how these issues should be interpreted in the coming Sections.

In the development of this study we have found the term “team” to describe a “*group of people, organized to work together, with a full set of complementary skills required to complete a task, job, or project*”[29]. On the other hand, the team concept in agile/lean paradigm has greater autonomy and attribution of responsibility, and is defined as “*cross-functional group of individuals that has the ability and authority to define, build and test – all in a short iteration timebox*” (SAF, 2015). In the development of this theory we are adopting the second team approach. While in a conventional approach the leadership role is focused on ***drive people*** to achieve results, as a keystone of Management Science (Harvard Business School, 2004). In the agile approach the main role of the leadership is ***induct people*** to achieve results. While the authority of a manager in conventional approach is vested to him/her, by members of the upper hierarchy of the company (the senior management, board of directors, steering committee). In an agile approach this *authority is conquered* step-by-step, and measured by the authority conferred on him/her by the team.

This parallel was depicted just to demonstrate the paradigm shifting necessary to adopt agile governance. So we can not expect a conventional approach works accordingly in a agile governance context. In fact, our previous work, MAnGve dedicates many reading hours differentiating both approaches and suggesting a set of principles, values and practices that can be adopted to become ***traditional managers*** into ***agile leaders*** (Luna, 2011a). For instance, the MAnGve practice named "Subtle Regency" proposes that driving of smart teams requires a subtle balanced combination between: imposed and emerging order (what in our theory is seen

[29] Elaborated as compilation of the “team” definitions from (BD, 2013; TFD, 2013).

as a chaordic behavior). It is as if the leader were carrying the *conductor's baton* in a symphony orchestra, such as a *Maestro*.

We will not delve into here on these issues, but we want to let the following warning: "*in agile governance: executives, managers and bosses should evolve to become participatory leaders and become integrated into the team*". Following the agile philosophy, they need to be an ***adaptable leader***, i.e., in his/her mission he/she: (1) keeps the focus on inspiring vision of the team; (2) promotes collaborative teamwork; (3) defends the project, product or service; (4) protects the team ; and, (5) remove obstacles to team progression.

Therefore, in this work, "team" is a word that can be applied for several complementary connotations in organizational context, such as: technical people, business people, and even the steering committee. However, the role of leadership become even more relevant in agile governance approach, despite the "self-organization" competency that needs to be fostered by the leaders in every instantiation of the team concept.

4.3 THEORY BUILDING PART ONE – Conceptual development

This conceptualization includes developing the theory's units, laws of interaction, system states, and boundaries. These initial four steps comprise Part One of Dubin's methodology for theory building research (see Sections 2.2.2 and 2.5.4).

4.3.1 STEP 1: Units of the theory

Theory units (or constructs) are the concepts of the theory, or the basic ideas that make up the theory, or knowledge plots from which the theory is built (Dubin, 1978). The units represent the things about which the researcher is trying to make sense and are informed by literature and experience, answering the first theory development question: "*What are the units of the theory?*".

Science deals with things, and all sciences must have a way of designating its subject matter (Dubin, 1978). Within a given science, the terms used to designate the relevant subject matter are the science's concepts (Dubin, 1978). If the term concept was only applied in this manner, it would be employed to mean the things out of which theories are built. However, the term

concepts can also refer to whole theories, or scientific laws or conceptual frameworks (Dubin, 1978). This confusion led Dubin (1978) to use the more neutral term unit to describe the properties of things out of which we build theories. It is important to point out that units, by themselves, are not theories. It is only when units are combined in models of the perceived world that theories materialize (Dubin, 1978).

In order to determine the concepts that would be included in the theory, we developed a set of *theoretical samplings* (described in chapters 2 and 3) including: the Systematic Literature Review (SLR-AG) about the state of art of Agile Governance, Observation on professional groups based on Social Networks, and semi-structured interviews with representative agents of the phenomena in study.

Dubin (1978) identified four properties of units. In addition to properties of units, Dubin (1978) also identified five different classes, or categories of units. These properties and classes are important because they affect how the unit may be employed in theory building. We elaborated **Table 4.1** and **Table 4.2** in order to make clear those distinctions.

Table 4.1 – Dubin's properties of units. Source: Adapted from (Dubin, 1978).

Characteristics and relevance	**Properties**		**Warnings**
The **first** unit property identified by Dubin (1978) is a distinction between attribute and variable units. The distinction between attribute and variable units is important because it influences the structure of tests that can be performed when validating a theory with empirical data.	A unit is an **attribute** if it is always present (e.g. gender).	A unit is a **variable** if it may be present to a degree (e.g. age or income). In the case of variable units, the degree of presence can be expressed on either a cardinal or ordinal scale.	N/A
The **second** property of units identified by Dubin (1978) is a distinction between real and nominal units.	**Real** units are units for which there is a high probability that empirical indicators exist.	In contrast, **nominal** units are units for which no empirical indicators exist today nor are likely to exist in the future.	The lack of empirical data with which to test a theory has led some theorists to discount nominal units. Dubin disagrees: *"This argument may be countered in a very simple way. The working scientist says that at some point, when confronting the empirical world, he needs indicators for the things he finds 'out there'. But, and this is critical, if he cranks up his curiosity only with those things for which he already has empirical indicators, then* ***(1) he probably***

Characteristics and relevance	Properties		Warnings
			will never attempt to discover new empirical indicators *(as he cannot think of looking for new things if his only tools of imagining are the representations of what he knows already), and (2)* ***he probably will devote a majority of this research to wholly trivial problems*** *(1978, p. 51)."*
The **third** property of units identified by Dubin (1978) is a distinction between sophisticated and primitive units.	**Sophisticated** units represent well defined units.	**Primitive** units, in contrast, are not yet fully defined.	While some researchers have argued that primitive units have no place in theory building research, Dubin again disagrees. Dubin's position is that primitive units are relevant under several circumstances such as when there is an empirical finding that is not yet attached to a theory or when a new theory is emerging.
The **fourth** property of units identified by Dubin (1978) is a distinction between collective and member units. The distinction between collective and member units is important because logical errors can result from dealing simultaneously with collective and member units in the same theory.	**Collective** units are those that describe an entire class or set of things.	**Member** units describe only individual things.	N/A

At this step, we have identified the units of the theory, whereas when during the process of identification of the attributes for each theory unit, they have emerged based on the following criteria of development: i) the application of the constant comparative method of qualitative analysis onto data with emerging categories (Glaser, 1965); ii) the balance between the frequencies of citation of them in all sources of the theoretical sampling chosen; iii) the representativeness desired by the theory design, trying to answer: how well the attributes can describe the construct; and, iv) the ability to translate the key characteristics of relevant meaning about the theory unit; and, finally, v) due the fact it can be applied in most instances of this theory unit, some of them found by complementary (exploratory) literature review about this topic.

Table 4.2 – Dubin's classes of units. Source: Adapted from (Dubin, 1978).

Class	Description	Example	Considerations
Enumerative	An **enumerative** unit is a property of a thing that is always present.	Thus, while age is an enumerative unit (people always have a specific age)...	That is, despite the condition of the thing, it will always have the specific property.
Associative	Alternatively, **associative** units represent properties of a thing that are only present under certain circumstances.	...income level is an associative unit (people may have a zero, or even, negative income level).	Associate units are identical to enumerative units with one critical exception. Associative units can have a zero or non-existent value.
Relational	**Relational** units present properties of a thing that can be discerned only by the relation among two other properties.	For example, the unit *sex ratio* is based on the interaction of two properties: male and female. --- E-I Index, the ratio of inter- group relationships to intra-group relationships, is clearly a relational unit.	The price theorists pay for this complexity is the risk of ignoring the "summing-up feature of the unit, which in turn may lead to an incomplete an inaccurate theory," (Dubin, 1978, p. 63). **1st unit's combination rule:** "A relational unit is not to be combined in the same theory with either enumerative or associative units that are themselves properties of that relational unit" (Dubin, 1978, p. 73).
Statistical	A **statistical** unit is a property of a thing that "summarizes the distribution of that property in the thing".	E-I Index, the ratio of inter- group relationships to intra-group relationships, might act as a statistical unit if we were to compare groups according to the E-I Index of each.	Statistical units can be categorized into three classes: (i) units describing a central tendency in the distribution of a property (ii) units indicating the dispersion of a property; and (iii) units identifying things by their relative position in a distribution of a property (Dubin, 1978). **2nd unit's combination rule:** Where a statistical unit is employed it is by definition a property of a collective. In the same theory, do not combine such a statistical unit with any kind of unit (enumerative, associative, or relational) describing a property of members of the same collective" (Dubin, 1978, p. 73-74).
Summative	Finally, **summative** units are those which stand for an entire complex thing comprised of multiple properties (Dubin, 1978).	"mass society", or even in economy we employ the designation "underdeveloped economy" to denote a wide set of properties that characterize such an economy (p. 66)	Summative units are thus the most complicated units. While they describe a great deal they are often poorly defined and unspecified. For this reason, Dubin (1978) contends that summative units, although useful for communication, may not be used in theory building. **3rd unit's combination rule:** "Summative units have utility in education of and communication with those who are naïve in the field. Summative units are not employed in scientific models" (Dubin, 1978, p. 78).

The following we will describe each of these elements on **Table 4.3**. The understanding of their meaning is essential to assimilation and application of this theory.

Table 4.3 – Theory's units: summary of classification. Source: Own elaboration.

ID	Unit	Short description	Sample of the unit's attributes	Dubin's classes of unit	Dubin's properties of unit (Dichotomous characteristics)
E	**Effects of environmental factors**	This unit conceptualizes the effects sensed by the organizational context, as a result of the influence caused by the external environment in which the organizational context resides.	• Technological impact • Regulatory institutions • Competitiveness • Economic effects • Market turbulence	[ ] Enumerative **[X] Associative** [ ] Relational [ ] Statistical [ ] Summative	[ ] Attribute or [X] Variable [X] Real or [ ] Nominal [X] Sophisticated or [ ] Primitive [X] Collective or [ ] Member
M	**Effects of moderator factors**	This unit conceptualizes the effects sensed by the organizational context as a result of the influence caused by moderator factors forming part of this context. Those factors tend inhibit or restraining the organizational performance, retarding its advance. The nature of these factors varies according to the particularity of each organizational context.	• Organizational culture • Leadership • Enterprise architecture • Business model • People qualification	[ ] Enumerative **[X] Associative** [ ] Relational [ ] Statistical [ ] Summative	[ ] Attribute or [X] Variable [X] Real or [ ] Nominal [X] Sophisticated or [ ] Primitive [X] Collective or [ ] Member
A	**Agile capabilities**	The ability to acquire, develop, apply and evolve competencies[30] related to principles, values and practices, from agile and lean philosophies on organizational context in order to: (1) overcome weaknesses; (2) potentiate the strengths; (3) avoid or face threats (and know when to do each one); and, (4) take a better advantage from opportunities.	• Flexibility • Leanness • Agility • Adaptability	[ ] Enumerative **[X] Associative** [ ] Relational [ ] Statistical [ ] Summative	[ ] Attribute or [X] Variable [X] Real or [ ] Nominal [X] Sophisticated or [ ] Primitive [X] Collective or [ ] Member
G	**Governance capabilities**	The ability to acquire, develop, apply and evolve competencies related to the way as an organizational context is conducted, administered or controlled, including the relationships between the distinct parties involved and the aims for which it is governed (such as: processes, policies, laws, customs and institutions), in order to: (1) overcome weaknesses; (2) potentiate the strengths; (3) avoid or face threats (and know when to do each one); and, (4) take a better advantage from opportunities.	• Strategic alignment • Decision making • Control • Compliance	[ ] Enumerative **[X] Associative** [ ] Relational [ ] Statistical [ ] Summative	[ ] Attribute or [X] Variable [X] Real or [ ] Nominal [X] Sophisticated or [ ] Primitive [X] Collective or [ ] Member
B	**Business operations**	This unit conceptualizes the set of organized activities involved in the day to day functions of the business, conducted for the purpose of generating value delivery, including (but not limited to): processes, functions, services, products, projects, practices, and behaviors.	• Business processes • Project approach • Practices	**[X] Enumerative** [ ] Associative [ ] Relational [ ] Statistical [ ] Summative	[ ] Attribute or [X] Variable [X] Real or [ ] Nominal [X] Sophisticated or [ ] Primitive [X] Collective or [ ] Member
R	**Value delivery**	This unit conceptualizes the ability to generate results (and become persistent the benefits arising from them) to the business by means of the delivery of value, whereas includes all forms of value that determine the health and well-being of the organization in the long run.	• Utility • Warranty • Time-to-market	[ ] Enumerative **[X] Associative** [ ] Relational [ ] Statistical [ ] Summative	[ ] Attribute or [X] Variable [X] Real or [ ] Nominal [X] Sophisticated or [ ] Primitive [X] Collective or [ ] Member

In total six units in Agile Governance Theory were identified: Effects of environmental factors, Effects of moderator factors [M], Agile capabilities [A], Governance capabilities [G], Business operations [B], and Value delivery [R].

[30] The term "competency" refers to a combination of skills, attributes and behaviors that are directly related to successful performance on the job (Landström et al., 2009; Zack, 2009).

The presentation of each unit follows the same format. First, the unit is **defined** and the sample of its **attributes** (instantiated to this characterization) is depicted. Eventually, other attributes can be discovered for each unit of theory, or considered more important in the specific nature of each organizational context for each application of the theory. The attributes depicted herein are intended to help describe and illustrate the essence of each theory unit for later application, but they are not a definitive list, neither an exhaustive reflective exercise about all their possibilities. In an adaptive theory these attributes can emerge in the course of time and must be analyzed (assessed, prioritized and discarded) according to every actuality faced. Indeed, they are much more depending on the organizational context, rather than a predictive modeling.

Next, the **construct validity** is discussed. In this context validity represents: (1) evidence of the unit's previous use in theoretical and empirical research; and/or (2) evidence of the unit's emergence from the data patterns observed in the theoretical sampling employed by this research. Finally, the **methodological logic** of the unit within Dubin's framework for classifying units is described.

Regarding to construct validity, we will develop a detailed discussion in Section 4.3.1.1.2 for the first theory unit, including an illustrative sample from its nomological network and its dimensions. However, for the remaining theory constructs, in each construct validity section, we will develop only a underlying discussion, and provide further detail in APPENDIX V.1.

4.3.1.1 Effects of environmental factors [E]

4.3.1.1.1 Definition

This unit conceptualizes the effects sensed by the organizational context, as a result of the influence caused by the external environment in which it resides. In other words, this construct characterizes the influence exercised by external environment's factors (or simply disturbing factors) that can generate disturbances (disorder, chaos, disarrangement or commotion) in the organizational context, influencing the performance of its operation in some level.

For instance, **agents** from external environment, such as government, market or competitors can generate **factors**, such as: legislation change, currency exchange rate, market share

reduction for a particular product or service (by launching of a new competing one). In fact, many factors from the external environment can interact among themselves influencing the internal environment in different ways. Those factors **affect** similarly every organizational context that resides at the same external environment. However, the **effects** sensed and realized by each organizational context depend on the nature and characteristics that distinguishes it from others. **This theory unit characterizes "this manner of sensing the effects from the external environment".**

Regarding to the nature of this construct, we can infer that the impact felt by each organizational context might be dependent on the "response ability" of each context, leading us to infer that those effects can be intimately related with the organizational competitiveness. In other words, this theory unit should cause more significant disturbing effects on less competitive organizational contexts than on more competitive ones.

For instance, considering *unpredictability* as the higher level of *uncertainty* on the external environment, the degree of *uncertainty* of the external environment when properly treated in the organizational context, by the combination of agile and governance capabilities, become *risks* and it in turn can be managed (Loch et al., 2007; Marinho et al., 2014).

Hence, for an uncompetitive organizational context (or with small degree of competitiveness) to handle uncertainty would be very hard, i.e., the effect caused by the *uncertainty* of the environment where an organizational context operates would be intense. We can cite as example, a project in the power industry (e.g., small hydropower plants), where the business requirements are based on the current legislation, in which the legislation is under reform process by the government. We can also exemplify, when the budget of a project is indexed to a foreign currency, during a period of global economic instability, regardless of the industry or economy sector. Both examples denotate the influences from factors that are beyond the control of their own organizational contexts.

Truth be told, we have recognize that there is a threshold where the uncertainty goes beyond the team's capacity to handle with them, where imponderable[31] factors usually transform the odds of any team giving equal chance to face the external environment effects. In spite of many projects would be under the influence of these same disturbing factors (associated with the

[31] Imponderable is a factor whose effects cannot be accurately assessed, foreseen or weighed, i.e., these factors are not susceptible to precise measurement or evaluation. Example: natural disasters, terrorism acts, political revolutions, economic crisis, despotism, etc. (TFD, 2013).

uncertainty of the external environment), those projects in which the teams are more competitive will be better prepared to deal with these *disturbing effects* than the uncompetitive ones, up to the limit of the imponderable.

We can also illustrate the characteristic behavior of this construct making an analogy to some laws of Physics from Classical Mechanics (Cohen, 1989). For instance, we might use the **Isaac Newton's First law** to illustrate the effect of the external environment on organizational context. In fact, as we have already mentioned the influence of the ***disturbing factors*** from external environment is the same for any organization that operates in the same market (environment), however the "inertia"[32] felt by each organization (competitors) can be described in terms of its "mass". In other words, a lighter enterprise (less massive or lean) will require less force (therefore, less energy) to overcome its "inertia", than a heavier enterprise (more massive or fat). On this illustrative example, the "mass" of each organization seems the determinant factor of the enterprise competitiveness (analogously represented here by the ability to overcome the inertia of an object at rest).

4.3.1.1.2 Construct validity

In favor of illustrate theory's unit validity, we present a sample from the many data patterns that we found from every source of theoretical sampling employed in this study. These evidences are related to the influence caused by the external environment on distinct organizational contexts, concerned to the behavior: "*they potentially cause disturbing (or disquieting) effects on organizational context*". For instance:

(1) In keeping with Janssen and Estevez (2013) [S147], while pursuing both objectives, governments face a major challenge—to operate in a **connected environment**, engage stakeholders and solve **societal problems** by utilizing new methods, tools, practices and governance models. Inferring the ***societal problems*** as a kind of disturbing factor of government context.

(2) *An IT Process Improvement Expert from Pennsylvania-US, points out, during a discussion in a social professional network about the "need of governance be agile": "The **external competitive environment** (which is moving *very* quickly in most industries) must be observed - not for purposes of 'steering' it, but for purposes of steering the enterprise to*

[32] Inertia is the resistance of any physical object to any change in its state of motion, including changes to its speed and direction (Cohen, 1989).

appropriately respond to it." – [NG07, 191:2][33]. Suggesting the ***competitiveness*** as an influential effect of industry environments, as well as a factor whose disturbing effect must be managed.

(3) *An experienced Software Engineer from the Federal Service for Data Processing of the Brazilian government points out that "Because... we are inserted in the public context, we observe that the **very bureaucracy hinders agility** from compliance issues of TCU [Brazilian Court of Audit]. Agility is a reality for [software] development, but what about other areas? There are many **barriers**..."* – [IT07, 204:317-323][34]. Inferring (among other things) that the ***excessive compliance*** issues demanded by external control bodies, create ***bureaucracy***, and consequently, those factors disturb the normal operation and drains the energy of the team to not core issues of the project.

Thus, this construct is a building block of the theory that represents the disturbing potential effects from factors of external environment (outside the organizational context), as aforementioned, which we complement with the following examples, but not limited to them, such as:

- **Technological impact**: As the impact caused by the technology (or absence of it) in the organizational context, comprising, but not limited to the following circumstances: technological obsolescence, shifting technological paradigm, etc. Imache et al. (2012) [S146] points out that the enterprise strategy is influenced by the socio economic, legislative and ***technology changes***. Moreover, they claim that the *globalization of the economy* makes the enterprise information systems more complex and *competition increasingly fierce*. So the enterprise, in order to ensure its survival and its sustainability, it must be agile permanently; that is, an enterprise must have fast adapting policy of its strategy and drive quickly important changes at all levels of all its dimensions in order to align them to its strategy and vice versa. In addition, Deshmukh (2013) [S134] points out that mobile Technologies will have the greatest positive impact on the businesses over next five years as it offers a valuable new marketing channel,

[33] The citations highlighted as **[NG*]** are data collected in our observation on professional groups based on social networks, mentioned at the stage 2 of the research framework depicted in Figure 2.1, and their complete characterization are available at APPENDIX III. References marked like this will be listed only in the mentioned Appendix to avoid duplication.

[34] The citations highlighted as **[IT*]** are data collected in our semi structured interviews mentioned at the stage 2 of the research framework depicted in Figure 2.1, and their complete characterization are available at APPENDIX IV. References marked like this will be listed only in the mentioned Appendix to avoid duplication.

particularly in emerging markets 51% of Financial Services executives said that they will invest in mobile technologies.

- **Regulatory institutions**: As a regulatory institution (also regulatory authority, regulatory body or regulator) is a public or private authority, market or government agency responsible for exercising autonomous authority over some area of human activity in a regulatory or supervisory capacity. These institutions also can have a narrow scope of operating, such as internal audit teams, bodies of supervision, software quality assurance units, etc. Chulani et al. (2008) [S1] report that legal/regulatory forms of governance and compliance often differ remarkably from internal forms of governance that corporations use to ensure they are meeting their strategic goals. Further, Mahnic and Zabkar (2008) point out that COBIT has also been used from the auditing perspective of agile development in, for determining compliance of the projects using agile techniques with Sarbanes Oxley Act (SOX), a ***regulatory requirement*** for all public listed companies in United States.
- **Competitiveness**: Refers to the ability and performance of an organizational context operates in a given environment (external or internal to the enterprise) in relation to ability and performance of other organizational context in the same environment. Competitive circumstances can be depicted such as: when two or more project teams are competing for budget/investment (it also can happen against other business units, or when many enterprises are competing for the same funding, or for the same customer portfolio). We can also illustrate competitiveness classically, when products in the same category are competing to increase their market share. According to Korhonen et al. (2009) [S23], decisions at the strategic level pertain to the organization's business models, long-term objectives, future directions as well as formulation of corporate objectives and policies. These decisions are usually made in the **face of external influences** – technical advances, market shifts, environmental factors, or **competition**. The mental process of an executive, such as general manager, at this level is parallel: several interlinked projects with interrelated goals are conducted simultaneously.
- **Economic effects:** Refers to an organizational context experiencing financial struggles due to many factors, such as: inflation, consumer confidence issues, unemployment rates, and rising prices. It can be also noticed in the context of teams, projects or business units, when there is late payment of the employees, delay in release of funds to the projects, or cause backwardness in the investments required by the company.

Economic instability affects businesses' ability to thrive, the cost of living, and the physical, emotional and financial well-being of consumers, customers, suppliers, partners and employees. As reported by Ribeiro and Barata (2011) [S10], on the verge of an economic crisis the industrialists started studying the best strategies to overcome the relatively high production costs and waste resulting from the production processes.

- **Market turbulence**: As the rate of change in the composition of market dynamics, comprising, but not limited to: customer's preferences, performance of competitors, volatility of business requirements, market uncertainties, and globalization. Mathiassen and Vainio (2007) [S27] mention that Eisenhardt and Martin (2000) define high velocity markets as ones in which market boundaries are blurred, successful business models are unclear, and market players are ambiguous and shifting. Also, According to Ktata and Lévesque (2009) [S5], today's turbulent business environment is compelling software development providers to face several challenges regarding their ability to react appropriately to their customer's needs. Further, Rycroft (2006) [S85] pointed out that market uncertainty has been moderating the direct effect of speed on successful innovation for public policy.

However, these effects do not occur in isolation. Indeed, mostly they are result of the confluence from many environmental factors. For instance, the ***Subject 1*** (an experienced Engineer and practitioner) has pointed out during the interview: "... *Any factor that affects the economy, any globalizing factor directly affects the sectors... any oscillation will impact directly in your pocket... these things are always oscillating*." - [IT01, 198:464-465]. And he continues "... *[I can see...] globalizing economic factors as a result the commodities that are regulated by the international market and government initiatives*" - [IT01, 198:485-488]. This evidence highlights these effects as consequence of mix of the influence from "*economic factors*", "*regulatory institutions*" and "*market turbulence*".

The previously presented factors can be seeing as dimensions[35] of the "effects of environmental factors", enhancing the validity related to it, once they help to understand the effects that are described by this theory unit, as well as they adequately express the patterns in the data which it intends to conceptualize.

[35] A relevant constituent of a (composite) theory unit.

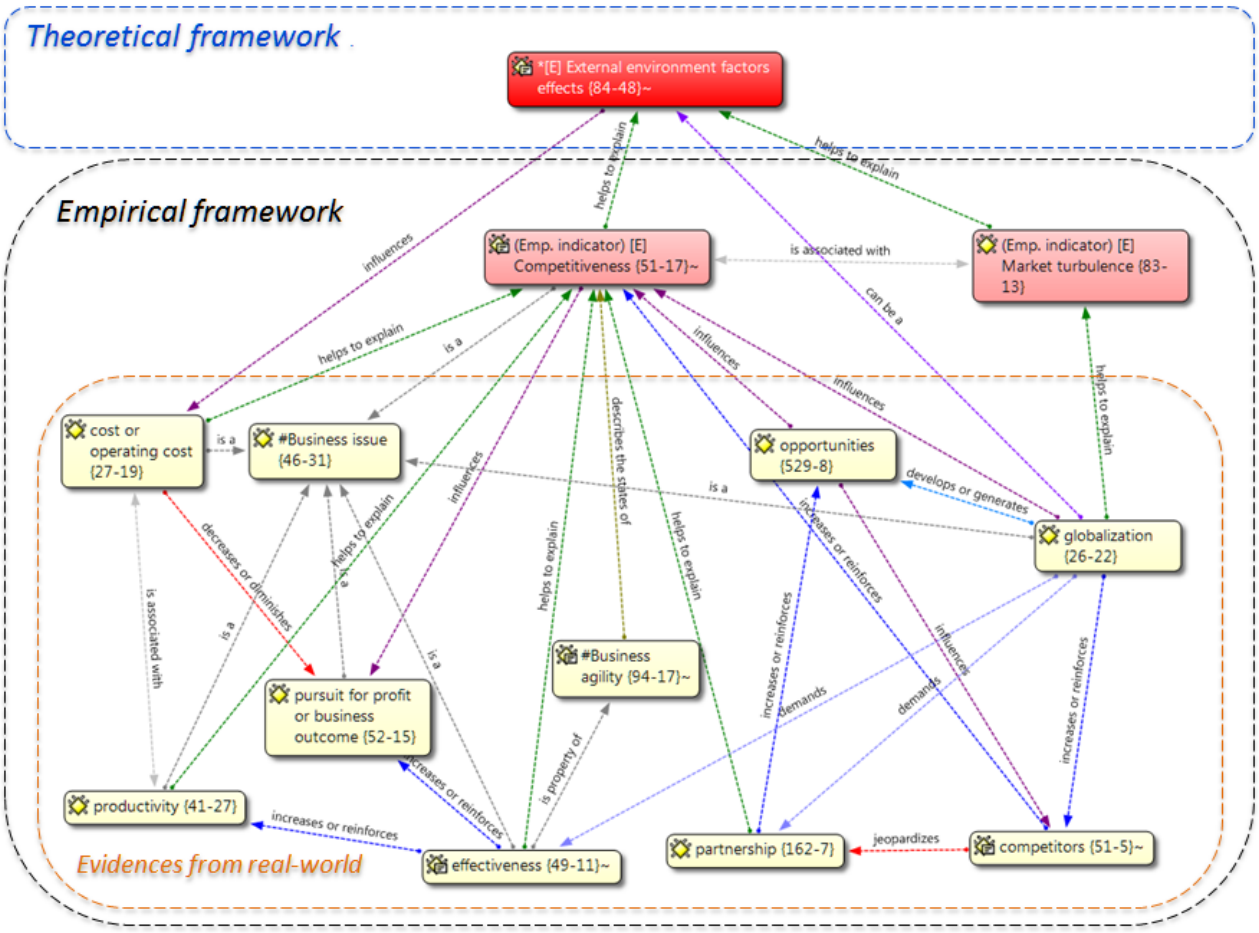


Figure 4.2 – Effects of environmental factors [E]: *Competitiviness* storyline. Source: Own elaboration.

For instance, just to illustrate one rationale from the many *storylines* captured from the nomological network depicted in **Figure V**.1, we will describe ***Competitiveness*** as an observable manifestation of the ***Effects of environmental factors [E]***. **Figure 4.2** depicts *Competitiviness storyline,* illustrating the following explanation:

> **Competitiveness** is an *empirical indicator*[36] from "effects of environmental factors [E]", i.e., one of the specific and concrete real world proxies for middle range theory concepts. ***Competitiveness*** <*is a*> ***Business issue*** [NG07][37], at same time as we can imply that ***Business agility*** <*describes the state of*> ***Competitiveness*** [S159]. This means that the level of enterprise competitiveness is closely related to business agility state. In other words, without establish a consistent level of competitiveness business agility cannot be achieved in its fullness [S129]. Simultaneously, the level of business agility can be used to describe the degree of competitiveness from an organizational context

[36] They are the actual instruments, experimental conditions and procedures that are used to observe or measure the concepts of middle-range theory Dubin (1978).
[37] The references pointed out in each relation are only a single illustration of the many evidences found for each relationship described from the sources of theoretical sampling chosen to this research.

(Li, 2014). In fact, as we will discuss in Section 4.3.4, business agility is a system state described by this theory.

Competitiveness <*influences*> ***pursuit for profit (or business outcome)*** [S139], e.g., because how much competitive are companies more profitable they can be. In turn, ***Competitiveness*** <*is associated with*> ***Market turbulence*** [IT08], another *empirical indicator* from "effects of environmental factors [E]", e.g., in a very turbulent market, competitiveness becomes an even more desirable capability. Naturally, the number of ***Competitors*** <*increases*> ***Competitiveness*** [S139] in the environment, as well as ***Cost (or operating cost)*** <*helps to explain*> ***Competitiveness*** [IT01], because to be competitive an organization should reduce its operational costs and make it compatible with its scale of business (scalability). As a consequence, ***Effectiveness*** <*helps to explain*> ***Competitiveness*** [IT10], by reason of this ability to become attractive for customers depends on the capability development to produce business desirable results, and competitive advantages.

In complement, ***Globalization*** <*influences*> ***Competitiveness*** [S152], because in an international integrated market arising from the interchanges of world views many factors drive organizations to be more attentive to the calls and behavior of this environment increasingly dynamic. So, in environment like that ***opportunities*** should be closely watched [S131], even though they can be result of ***partnerships*** [S8], which in turn influences the organization modus-operandi, and consequently company ***productivity*** [S132], helping to explain the ***Competitiveness*** required to handle with all these ***[E] External environment factors effects*** [IT02].

For a matter of length and simplicity we will not describe an example of the rationale for every *storyline concept* derived from the *nomological network* built for each theory unit, depicted in **Figure V**.1 (or in the subsequent ones, for the other constructs). This exercise was just carried out to this empirical indicator of this construct [E], just to give a clear view of the procedure employed to build the construct validity into the nomological network.

Further details about the density of evidences found in every data collection source related to this theory unit, as well as an illustrative sample of the construct's nomological network, are available in APPENDIX V.1.

4.3.1.1.3 Methodological logic

Dubin (1978) emphasized the importance of characterizing and classifying the nature of units used in a theory. Units, he argued, must be differentiated "*in order to draw out their consequences*" (p. 37). As discussed at the beginning of the Section 4.3.1, units can be differentiated by both their properties, which represent **dichotomous characteristics** (i.e. *attribute* versus *variable*, *real* versus *nominal*, *primitive* vs. *sophisticated*, and *collective* versus *member*), as well as by their **class** (i.e. *enumerative*, *associative*, *relational*, *statistical*, and *summative*). This subsection, for each theory unit, aims classifies the construct according to these properties: **dichotomous characteristics** and **class.**

Regarding to the *class* property, ***Effects of environmental factors*** [E] is interpreted as an *associative* unit of the theory, because it is a property of an organizational context that can be only present under certain circumstances, even that in specific level of representativeness, or represented by different factors (instances of units).

Dubin's (1978) methodology also requires that units be characterized about their unity properties or their *dichotomous characteristics.* The implications of these characteristics for each unit will be further developed in Section 4.4.2 with the specification of empirical indicators for the units. In short, application of Dubinion logic on to the unit ***environmental factor effects*** [E] clarifies that the unit is *variable*, because it may be present to a degree. This is *real* due to there is a high probability that empirical indicators exist. Further, it is *sophisticated* on account of it represent well characterized unit, as well as it is *collective* because it describes an entire class or set of things.

4.3.1.2 Effects of moderator factors [M]

4.3.1.2.1 Definition

This unit conceptualizes the effects sensed by the organizational context as a result of the influence caused by moderator factors forming part of this context. In this theory "moderator factors" exerts over organizational context a kind of effect which opposes the organizational performance.

These factors act as an intrinsic resistance of the organizational context, and their nature varies according to the particularity of each one. As a consequence these factors can inhibit or restraining the organizational performance.

The "moderator behavior" of this theory unit deserves a special attention. A particular factor can change over time, in same organizational context, according to the moment experienced by it, changing from moderator behavior (described by this construct) to an enabler behavior, when it is empowered by the combination of agile and governance capabilities. For instance, the **organizational culture** can be refractory at an initial time (moderator effect), causing effects of inhibit or restraining upon the organizational context and retarding its advance. And after some cycles of this theory it becomes appreciative and stimulating, influencing positively the same context (enabling effect). In other words, not every moderator factor has negative (or permanent) effects, but when they do it, tend to inhibit or restraining the organizational performance, retarding its advance.

These factors must be worked out by the organizational context, to stop being moderators and become themselves enablers. This transformation is the mission of the theory units that will be described on the following Sections: agile capabilities [A] (section 4.3.1.3) and governance capabilities [G] (section 4.3.1.4).

We can infer that the level of "moderating effect" of those factors depends on "sustainability" of each **organizational context**. We will dig deep on this issue, when we discuss system states in Section 4.3.4.

For instance, factors such as leadership, organizational architecture, business model and people qualification, regularly can intervene upon the organizational context limiting its performance, whether they were not properly addressed.

It is important to understand that, when we mention "moderator factor" on the context of this theory, we are not focus on the concept of "moderation" addressed by Statistics, widespread by classical references about the nature of moderator behavior of variables such as by Baron and Kenny (1986).

Further, we can use the **Force of Friction**[38] from *Classical Mechanics in Physics* to illustrate the effects of moderators factors from internal environment on the organizational context. As

[38] The friction force is the force exerted by a surface as an object moves across it or makes an effort to move across it (Cohen, 1989).

mentioned, these factors have an attenuating influence, and can act as inhibitors or restrainers on the enterprise's endeavors, reducing the velocity (or increasing the energy or/and time spent) in which the results can be achieved. However, the moderators factors, even as the *coefficient of friction*, depends on the particularities of each context. Using a physics language, it depends on the nature of the materials in contact during a movement (e.g., ice on steel has a low coefficient of friction, while rubber on pavement/asphalt has a high coefficient of friction). Hence, reduce the coefficient of friction to guarantee, that once inertia is overcome (effects of the environmental factors, as illustrated in Section 4.3.1.1.1), the team can develop a sustainable trajectory with a minimum waste of energy, and with minimal loss of speed, is a mission of the organization context and the people who compose it.

4.3.1.2.2 Construct validity

The "effects of moderator factors" emerged, from the triangulation among the data collection source of this research, as a category where fit several concepts related to the same pattern behavior: "*they potentially cause restraining (or limiting) effects on organizational context*". For instance:

(1) The CEO of a Canadian Software company (Vancouver), highlights in a debate in a social professional network about "governing agile teams": "*Governance implies a **'fiduciary duty'** to influence outcomes in a positive manner for the investor in software. It's roots are from 'Tort Law'. Too often, this influence is bordering on negligence, with a fundamental **lack of appreciation** of the software development system put in motion*." - [NG03, 186:3]. Implying ***compliance*** as a kind of moderator factor.

(2) Rycroft (2006) [S85] points out that a survey of 30 projects in 12 British companies reported that **leadership style** influenced the speed of development. However, the **source of the technologies** used in the project (i.e., internally developed or externally acquired) moderated the link between the **style of leadership** and **development speed** [S85, 85:407]. Suggesting ***leadership style*** and ***technology impact*** as a kind of moderator factor.

(3) A senior Software Project Manager from a renowned Brazilian center for advanced studies and systems (which at that time he was developing a project for PETROBRAS), reports during the interview "*In my staff, I had a guy who was Adventist [from Seventh-day Adventist Church], and then from the five o'clock on Friday he did not work more.*

Whether we schedule anything over the weekend about project we could not rely on him. In addition, we had a guy who was a Jehovah's Witness and had a girl who was Gospel, so when we wanted to make some socializing in the group [to reinforce the team play[39]], we always had to manage those restrictions: we could not schedule on Friday or on Saturday and neither on Sunday... Indeed, we had to schedule during the week days because of them! Limiting factors such these have happened very often within the team due to ***individual culture*** *and* ***personal beliefs****, and we had to respect the individuality of each team member... but these factors have impacted the* ***organizational culture****, leading us to adjust our manner to work on the project."* – [IT02, 199:537-549]. Implying the ***organizational culture*** as a type of moderator factor.

Thus, this construct is a building block of the theory that represents the attenuation potential effects from factors as aforementioned which we complement with the following examples, but not limited to them, such as:

- **Organizational culture**: As the customs, rituals, and values shared by the members of an organizational context that have to be assimilated by new members, and influences how this organizational context operates. According to Demirkan et al. (2008) [S82] , the business environment and organizational culture of different enterprises also may play a big role in *mitigating the success* and realized business value of implementing service-oriented systems.

- **Leadership**: As a process of social influence in which a person can enlist the aid and support of others in the accomplishment of a common goal (Chemers, 2014). For instance, according to Kamoun (2007) [S13], a *strong leadership* that eloquently articulates the organization commitment and support for a sustained BPM-SOA initiative is required. Strong leadership is also a prerequisite for the adoption of comprehensive cost-reduction, quality of service and business compliance requirements strategies that are core elements in the BPM-SOA value proposition. Implying that the **lack of "strong leadership"** can be a kind of moderator factor.

- **Enterprise architecture**: In one sense it literally refers to the organization in its built environment and in another sense it refers to architecture metaphorically, as a structure which fleshes out the organizations, comprising, but no limited to the following topics: organizational structure, infrastructure, scalability/modularity of the

[39] Collective effort and mutual cooperation.

enterprise workforce, centralization/decentralization related to operation and decision making. In fact, *IT governance centralization* is pointed out by Tiwana and Konsynski (2009) [S15], as a moderator factor. In other words, they advocate that the degree to which IT specification and IT implementation decisions are made by the line functions *vis-à-vis* the IT department. IT specification decisions pertain to what business processes in the line functions IT must support, the associated constraints (schedule, budget, quality), objectives, priorities, and performance expectations (e.g., service levels). IT implementation decisions pertain to the methods, programming languages, platforms, definition of IT standards and policies, and IT sourcing.

- **Business model**: As the rationale of how an organization creates, delivers, and captures value (economic, social, cultural, or other forms of value). The process of business model construction is part of business strategy (Burkhart et al., 2011). As reported by Phillips and Wright (2009) [S87], Gardner and Ash (2003) emphasize the nonlinear and emergent nature of the necessary changes and consider corporate intent and strategy, application of the business models as a moderator agent. Further, Mathiassen and Vainio (2007) [S27] advocate that the centralized approach, in the business model of the company where they were conducting a case study, was becoming inappropriate for coordinating the responses to increasingly diverse needs and requests. Moreover, High et al. (2008) [S19] describe how the business model and its capacity of adjustments and evolution to the business need is a key element to the effective collaboration among players from a value chain, such as: company, suppliers and customers. Inferring the *business model* as a potential moderator factor [19:349].

- **People qualification** and **motivation**: According to Heston and Phifer (2011) [S90], Resource Management is an pillar of the ISO9001 (including Sections: 6.2.1 **Competence of personnel**, 6.2.2 **Training awareness and competence**) provides for establishing procedures for identifying training needs, **qualification of personnel**, training on specific customer requirements, and training records. In complement, the CEO of a Canadian Software Development company, during a discussion in a social professional network about "governing agile teams", points out that "*Instead, with a rudder, steerage becomes 'refactor our approach' rather than follow the same tactics in a dead reckoning fashion; **'improve our people'** through **pin-pointed knowledge and skills transfer**; 'exercise our technology options, before it is too late' through decision centric*

> *architecture*." [NG03, 186:19]. Further, a Senior Consulting of a multinational consulting firm claims: "*I tend to promote the idea that governance should be collaborative in nature, with a focus on* ***motivating and enabling people*** *to do the right thing as opposed to trying to command them to do so*."[NG03, 186:29]

The same as the previous theory unit, the moderator factors effects [E] do not happen separately. They are consequence of association of the influence of several moderator factors from inner environment. As evidence from this phenomenon we might cite a CEO from a Brazilian software company specialized in educational and social technologies, which have vented during the interview: "... *Usually the 'only thing I do' is focus on strategic matters. I can do that because we have 'shared the coordination' of company [steering] between four executives, so other decision (than is not strategic decision) can be made for each one in his or her area of competence... However, before was not that so! People did not give a step without consulting me. Currently, the whole team realizes that the* ***decentralization of decision-making process*** *and subsequent improvements in our* ***business model****, gave us more* ***flexibility*** *and* ***agility****.*" – [IT05, 202:880-885]. As a consequence we can imply the moderator effects from "inadequacy of business model" as a combination of the influence of "centralized decision-making process" and "rigid enterprise architecture", at the same time as we realize its favorable relation with "decentralized governance mechanism" in order to achieve ***enterprise flexibility*** and ***business agility***.

Those factors can be considered dimensions of the "effects of moderator factors", enhancing the validity associated to it, because they help to explain the effects that are described by the construct, as well as they adequately express the patterns in the data which it purports to conceptualize.

Further details about the density of evidences found in every data collection source related to this theory unit, as well as an illustrative sample of the construct's nomological network, are available in APPENDIX V.1.

4.3.1.2.3 Methodological logic

The unit "***effects of moderator factors****"* is a *variable* unit of the *associative* class. This construct is a variable unit because the effects of moderator factors can be present to a degree. The

organizational context will be affected by moderator factors in varying degrees (and different instances of moderator factors), according the level of agile governance experienced by it.

Further, because we can imagine the condition in which no moderator factors [M] attenuating the business operations [B], effects of the moderator factors is of the *associative* class; the unit can have a zero value. This is *real* due to there is a high probability that empirical indicators exist. Further, it is *sophisticated* on account of it represent well defined unit, as well as it is *collective* because it describe an entire class or set of things.

4.3.1.3 Agile capabilities [A]

4.3.1.3.1 Definition

According to Vincent (2008), **capability** is a feature, *faculty* or process that can be developed or improved. Capability is a *collaborative* process that can be deployed and through which individual **competences** can be applied and exploited. The relevant question for capability is not "*Who knows how?*", but "*How can we get done what we need to get done?*" and "*How easily is it to access, deploy or apply the **competencies** we need?*"

On the other hand, according to (Campbell et al., 2010), **competence** is the quality or state of being functionally adequate or having sufficient knowledge, skill, and attitude. Competence is another word for an individual's know-how or skill. When we are asking whether we have the right competencies are not we really asking, "*Who knows how?*", and "*How well do they know?*". Horey et al. (2004) have used competence as an essential principle when they recognized that management and leadership are all about getting the right people in the right place at the right time.

As a matter of clarity, we will adopt in this work the concept "*capability as the ability to acquire, develop, apply and evolve competencies*". On that basis, *this unit conceptualizes the capabilities to develop competencies related to principles, values and practices, from agile and lean philosophies*. According to the emerging theory the development of these competencies on organizational context should be motivated in order to: (1) overcome weaknesses; (2) potentiate the strengths; (3) avoid or face threats (and know when to do each one); and, (4) take a better advantage from opportunities.

In turn, the term "**competence**" refers to a cluster of skills, attributes and behaviors that are directly related to successful performance on the job (Landström et al., 2009), supported by three pillars: (i) **knowledge**: "To know what and why to do"; (ii) **skill**: "To know how to do"; and, (iii) **attitude**: "To wish to do" (Krueger, 2003).

For instance, *core competencies* are the skills, attributes and behaviors which are considered important for all staff of the organization, regardless of their function or level (Landström et al., 2009). On the other hand, *managerial competencies* are the skills, attributes and behaviors which are considered essential for staff with managerial or supervisory responsibilities (Zack, 2009). Keeping that on mind, *agile capabilities* handle with the development of *agile or lean competencies*, in order to enable *organizational context* to achieve *organizational agility*, which refers, in the broadest sense, to the *capability of an organization to effectively sense and rapidly respond to change and complexity* in ways that increase that *organization's ability to thrive, and to remain true to its highest aspirations* (Hamman, 2013).

In essence, agile capabilities are dedicated to develop competences, aiming to deliver value faster, better and cheaper to the business, taking into account the following key elements: (i) **sensing ability**: "the instinctive ability to sense and react coordinately"; (ii) **positive attitude**: "the mindset to create favorable conditions to reach positive outcomes"; and, (iii) **readiness**: "the ability to be ready, willing, and able for action".

4.3.1.3.2 Construct validity

Regarding to theory unit validity, agile capabilities [A] arise from dynamic capabilities perspective. In turn, the concept of dynamic capabilities arose from a key shortcoming of the resource-based view (RBV) of the firm (Eisenhardt and Martin, 2000). Teece et al. (2007) define **dynamic capabilities** as "*the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments*". Dynamic capabilities thus reflect an organization's ability to achieve new and innovative forms of competitive advantage given path dependencies and market positions. We can imply that both agile capabilities [A] and governance capabilities [G] fit properly in these characteristics.

As stated by Mathiassen and Vainio (2007) [S27], to survive and be successful in turbulent business environments, firms must: (i) "respond to the anticipated and unexpected changes in proper ways and due time" [agile capability], and (ii) "exploit changes and take advantage of

change opportunities" [governance capability]. This implies having "change competency" (Kidd, 1997), being "proficient at change" (Dove, 2002), or exercising "appropriate and systematic organizational response to change" (Haeckel, 1995), what we can infer as an "agile governance competency" [AG]. Organizations with these traits have transformed their strategy, structure, and governance to practice a sense-and-respond mindset (Haeckel, 1985), and they have learned to manage and apply knowledge effectively to thrive in continuously changing and unpredictable business environments (Haeckel, 2004).

Such adaptive behaviors are enabled by specific dynamic capabilities, which, according to our theory, are part of the coordinated combination of agile [A] and governance [G] capabilities. We can provide more examples, such as:

(1) Baars and Zimmer (2013) [S126] points out a cluster of agility attributes (supported by many authors) seeking emphasize its multifaceted nature and encompass its definitions. They have grouped these attributes in three groups, which we can interpret through the lens of emerging theory, as agile capabilities [A], such as:
    a. "Outcome oriented", highlighting "agility" with a desirable outcome of a system (the fast and timely reaction to an unforeseen change from outside), which can develop [agile] competencies such as: "ability to react to uncertainty/unforeseen changes in requirements", "speed and timeliness", etc.
    b. "Behavioral abilities", focusing on the behavior of the system or the ability for this, which can cultivate [agile] competencies such as: "sensing and responding", "actively seizing opportunities", etc.
    c. "Structural traits", which consider agility as a structural trait of a system, i.e., it is particularly flexible and efficient. In some cases, concrete features of the system are referred to, which can design intrinsic [agile] competencies such as: "flexibility", "dexterity", "variability", "availability", "leanness", "efficiency", "affordability", etc.
(2) Further, an experienced IT executive from an UK firm in London, points out that "*My view on Agile Governance is: flexible, dynamic, proactive and at the same time follow changed business/market conditions to reflect demand in governance for which is responsible/accountable. I think that in such cases Agile approach/culture concentrate on results achievement and change implementation, if necessary, rather than on strict processes following, etc.*" – [NG10, 194:3].

(3) A senior Software Process Auditor from a Software Technology Excellence Centre in Recife-Brazil, pointed out during the interview: "*I really believe in agile and lean skills or capabilities (as you are calling), they will always add value in the day-to-day! The difference is: Will I use it? All of them, at same time? Or some of them, in an adaptive way? So I'll use that which adds more value to the business, at the moment. Will I use it in all its fullness? Maybe not, maybe I need to adjust it to my actuality, restricting some things depending on the flexibility that the business need.*" – [IT06, 203:523-529]. And he has continued: "*Recently, I went to an event that the guy was talking about agility, right? The lecturer [a well-known Brazilian agilist] was talking about the future of Scrum... and in short, he [lecturer] wanted to say that the use the guideline in their entirety is foolishness. For instance, he has advocated the use the Scrum adapted that adds value to your context. And he has mentioned some success cases of Scrum BUT and Scrum AND* (Schwaber, 2012)." – [IT06, 203:531-545]. Implying the ***need of adaptability*** demanded to handle with agile capabilities, in order to become useful and effective their application.

Agile capabilities [A] attempt to act as a buffer between firm resources and the changing business environment, dynamic resources help a firm adjust its resource mix and thereby maintain the sustainability of the firm's competitive advantage, which otherwise might be quickly eroded. Hence, these capabilities emphasize resource development and renewal, and thus may be particularly useful to firms operating in rapidly changing environments.

Therefore, even if Information System resources do not directly lead the firm to a position of superior sustained competitive advantage, they may nonetheless be critical to the organization's long-term competitiveness in unstable environments if they help it to develop, add, integrate, and release other key resources over time.

From this review we can see that different researchers and practitioners provide certain insights into different aspects of agility providers, as agile capabilities [A]. It is highly probable that there is no single set of agility providers reflecting all aspects. Thus, this unit of the theory that represents the ability to acquire, develops, apply and evolve agile and lean competencies, was organized in the following dimensions, but not limited to them, such as:

- **Flexibility**: As the capability to adjust (adequate) itself to handle with unexpected situation. For instance, assimilating the change, having resilience to deal with it. Truly,

Makhlouf (2012) [S154] advocates that in a context where changes are perpetual and multidimensional, the companies must adapt quickly and consider this turbulent environment as an opportunity and not as a threat. In order to grow or even to survive they need to increase their competitiveness, improve their results and strengthen their agility and ***strategic flexibility***. In addition, a (retired) graduate official of the Finnish Army claims that "*From Lean Improvement approach agile governance makes sense when one defines his KPI's in a way that they gradually improve the speed of change of his processes and organization. This increases your* ***flexibility*** *and not the normal feature of policy, when it becomes a self-sufficient 'order' and in worst case a 'culture'. Culture and order in this context are negative features!*" - [NG08, 192:4].

- **Leanness**: As the capability "to do more with less", tackling wastes, keeping the things simple, reusing resources. According to España et al. (2012) [S139], lean approach advocates defining value from the perspective of the customer, striving for perfection, continuous improvement, and reducing waste. Barton (2013) [S128] considers how UK police performance might be improved through the adoption of a 'Lean' philosophy. In addition, Carter et al. (2011) [S93] points out New Public Management (NPM) as a tendency in lean government, enhancing the effectiveness of the back office clerical work in the British civil service, UK.

- **Agility**: As the capability to react to changes faster than the rate of these changes, anticipating change when possible, analyzing and reacting quickly to it. Imache et al. (2012) [S246] cite that Conboy and Fitzgerald (2004) draw on the concepts of flexibility and leanness to define agility as the continual readiness of an entity to rapidly or inherently, proactively or reactively, embrace change, through high quality, simplistic, economical components and relationships with its environment. In addition, Knaggs, Pollard & Wang (2012) [S148] report how the U.S. Supply Services (USSS) is starting to implement an agile process of contracts, procurement and supply chain, in order to supply equipment primarily to the U.S. military services.

- **Adaptability**: As the capability itself to adapt evolutionarily, to handle with the changes naturally as part of the business environment. For instance, adjusting itself in an evolutionary manner, developing new strategic features as competitive advantages. Wilkinson (2006) [S115] discusses how Hewlett Packard Inc. is facing the challenges to adjust its enterprise architecture to become itself an agile and adaptive enterprise, in

order to provide flexibility and adaptability of information technology (IT) services to their customers. Further, Yuan & Yu (2010) [S29] define a Synergic (and adaptive) Quality Management approach and a collaborative Decision-making Model for Agile Supply Chain.

However, these competences are not isolated from each other; neither they should be developed in disjointed fashion. They are supplementary and their combined application can result in an outcome better than when we apply everyone separately. For instance, Qumer & Henderson-Sellers (2008) [S75] propose an Agility Calculation Method based on the five agility features of flexibility (FY), speed (SD), leanness (LS), learning (LG) and responsiveness (RS), to assist managers in assessing the degree of agility they require and how to identify appropriate ways to introduce this agility into their organization.

These capabilities can be considered relevant constituents of the "agile capabilities", enhancing the validity associated to this theory unit, because they help to explain features, faculties or processes that can be developed or improved, which in its combination describe the nature of this construct, as well as they adequately express the patterns in the data which it purports to conceptualize.

Further details about the density of evidences found in every data collection source related to this theory unit, as well as an illustrative sample of the construct's nomological network, are available in APPENDIX V.1.

4.3.1.3.3 Methodological logic

Agile capabilities are interpreted as an *associative* unit of the theory, by reason of it is a dynamic capability that can be present alone under certain circumstances (see Beginner Scenario (φ_0) in Section 4.5.3.1), even that in specific level of representativeness, or represented by different capabilities combination at distinct time period, before and after starting the theory application.

Regarding to Dubin's properties of units, agile capabilities is *variable*, because it may be present to a degree. This is *real* due to there is a high probability that empirical indicators exist. Further, it is *sophisticated* on account of it represent well defined unit, as well as it is *collective* because it describe an entire class or set of things.

4.3.1.4 Governance capabilities [G]

4.3.1.4.1 Definition

Following the same approach adopted to define the agile capabilities [A], the governance capabilities [G] also emerge from *dynamic capabilities approach*. In fact, we would describe governance capabilities [G] as the ability to acquire, develop, apply and evolve competencies related to the way as an organizational context is conducted, administered or controlled, including the relationships between the distinct parties involved and the aims for which it is governed (such as: processes, policies, laws, customs and institutions), in order to: (1) overcome weaknesses; (2) potentiate the strengths; (3) avoid or face threats (and know when to do each one); and, (4) take a better advantage from opportunities.

In fact this meaning is quite align with the Cadbury (1992) Report about the financial aspects of corporate governance, which it has been used to varying degrees to establish other codes such as those of the European Union, the United States, the World Bank etc. In other words **governance capabilities** are close related to the steering process, focus, "*maneuverability*" and strategic approach of the organization, business units and its projects. In fact, this construct conceptualizes aspects primarily related to mechanisms, responsibilities and accountabilities through which the authority is exercised, decisions are made and the strategy is coordinated and steered on the organizations, whether they are a country, an enterprise, a specific sector or a project.

We have found a very broad series of governance capabilities in the literature, such as: definition and implementation of policies, decision making, accountability, definition and implementation of control mechanisms, strategic alignment, portfolio management products, services or projects; compliance, etc.

In essence, governance capabilities are dedicated to develop competences, aiming to give to the each business unit and at same time to the entire organization the ability to *maneuver* itself and respond coordinately, supporting its overall strategy. This ability to drive and coordinate to the business, takes into account the following key elements: (i) **strategic alignment**: “the instinctive ability to define what is crucial to do”; (ii) **steering**: “the power to act and direct a course”; and, (iii) **control**: “the authority and ability to ensure the accomplishment”.

4.3.1.4.2 Construct validity

Concerning to the construct validity, we already have advanced the discussion in the Section 4.3.1.3.2, when we have considered that governance capabilities [G] conjointly with agile capabilities [A], inherit the same resolution of dynamic capabilities.

According to Pardo and Burke (2008) ***governance capabilities*** provide the appropriate decision making rules and procedures to direct and oversee related initiatives that are planned, underway, or implemented to create new capability for interoperability.

Such "steering capabilities" [G] are developed and enabled by specific dynamic capabilities, which, according to our theory, achieve better results when coordinated and combined with agile capabilities [A]. Some examples can be provided, such as:

(1) Xu and Kim (2014) have proposed ***collaborative governance capabilities*** as one class of *organizational BI capabilities*. They have defined collaborative governance capability as the capability to define and oversight responsibility and accountability, and to facilitate problem coordination, which is comprised by two types of collaborative capabilities: (i) *explicit coordination capability*, that refers to articulated, written policy and governance framework among business functions; and, (ii) *dynamic coordination capability*, which is defined as the ability to organically coordinate among various parties.

(2) The CEO and CTO of a Canadian Software company in Vancouver, highlights "*The work we are doing is to connect the term governance with risk mitigation - i.e. that bad things can and do negatively affect outcomes due to uncertainty. Therefore, to govern means to improve how the project/endeavor* ***makes decisions****. This is the gist of what I call* ***'Decision-centric Capability Improvement'****. For many reasons, we humans make* ***poor decisions****, which lead to suboptimal results. Various forms of cognitive bias are always possible, as is* ***decision fatigue*** *due to the pace of change and dynamism in software projects. So governance should be about steering humans away from poor decisions*." - [NG03, 186:9]. And he continues: "*Three major* ***types of decisions*** *can be influenced to make governance more than just reading a bunch of pretty dashboards and jumping up and down when things look to be going into the toilet. 1) approach decisions (akin to DAD's[40] goals-driven knowledge support), 2) staffing decisions which match skills and available staff to the approach choices taken, and 3) high-stakes technology decisions*

[40] **Disciplined Agile Delivery** (DAD) is a process decision framework that enables simplified process decisions around incremental and iterative solution delivery [S122, S132].

(aka architecture). All these decisions must be made in the presence of feedback to effect any steerage." - [NG03, 186:10]. Implying ***decision making*** as a key competency for governance capabilities in software projects development.

(3) An experienced Software Engineer from the Federal Service for Data Processing of the Brazilian government discusses that "*I totally believe in **agile governance concept** and in the **capabilities** we need to develop to make it real. We're being charged by the company, for the whole company, to work in an agile way... now! Then agility is already a reality in the development [specific agile approach]... But from now on staff wants the **whole company works within an agile culture** and it can be aligned with principles and values for the entire organization [agile governance approach]. The organization is establishing its own 'governance framework', so that agility can also be applied to IT service management, to infrastructure, to software development, clerical work, **having a whole 'service menu' beyond the parts that are being assembled** [business operations]. That is the context is really that, at least what they preach today, is that this is no going back! It's not a fad, it is not something that this government [mandate] or another government come and take it from the company context but now, that's the reality hereafter*." – [IT07, 204:244-255]. Inferring the development of ***agile and governance capabilities*** as irrevocable and urgent needs in his organizational context.

As a building block of the theory, this construct represents competencies related to the way as an organizational context is governed, which we complement with the following examples, but not limited to them, such as:

- **Strategic alignment**: is related to the establishment of procedures, behaviors and practices to ensure the continuous alignment of decisions and action with the overall strategy, as well as the analysis of how much the governance capabilities are closely associated with the business strategy. For instance, keeping the operations in line with the business strategy, doing the right thing, prioritizing initiatives, among others. Dubinsky et al. (2011) [S137] have defined business-IT alignment as the application of IT in an appropriate and timely way and in harmony with business strategies, goals, and needs. They cite many studies that have found that the alignment of business and IT strategy positively affects business performance, and that improved business-IT alignment maturity increased the ability of a case organization to launch a new business strategy. Furthermore, they advocate that best results are achieved when IT decisions

are made by continuously integration between the IT function and other aspects of the organization. Further, ***decision making*** and ***strategic alignment*** are closely related, as indicated by Schantz (2013) [S151] as follows: "*Having a strong and understandable strategy makes it easy to function and take decisions at every level of the organization as required. It is important to ask two questions of yourself when making a decision: (1) Is the decision aligned with the strategy? (2) Will the decision have a positive effect on the value of the company?*"

- **Decision making**: as the systematic cognitive process for reaching decisions at all levels of the organization, ensuring effective decision making on business operations. In other words, reducing more complicated decisions down to simpler steps, weighing up the risks involved, weighing up the pros and cons of each course of action, among others. In keeping with Mykityshyn and Rouse (2007) [S7], ***leadership decisions*** are typically made based on judgments of and reactions to the current and **emerging state of the environment exogenous to the enterprise**. Judgment is also dependent upon the ability of the executive team to acquire a base knowledge of the marketplace, industry, and most importantly, the business. Quaadgras et al. (2011) [S161] have also discussed the importance of embedding information in work processes to enable better judgment in complex environments, as well as ways to capture human expertise to improve work processes and outcomes.
- **Control**: is associated to processes and mechanisms implemented in an organization to help in achieving specific goals, by monitoring and/or verification of its outcomes, and subsequent adjustments "to ensure the strategy accomplishment" on business operations, e.g., establishing mechanism, policies, accountability, among others. Bartenschlager and Goeken (2010) [S62] points out that according to Zmud (1984), when the structural form of an organization is functional, the objective is that internal efficiency and strong hierarchical control is necessary to ensure the overall success (mechanistic), but when the form is organized around products and services, the focus is on external effectiveness (organic). Cheng et al. (2009) [S63] describes the control mechanisms as key elements to agile governance aims, citing them explicitly in their phenomenon definition for the environment where the software development team is present: "*the accountability and responsibility of management, adopting agile software*

*development methods, and establishing **measurement** and **control mechanisms** in an agile environment*".

- **Compliance**: regards to the establishment of procedures, behaviors and practices to ensure the conformity of the decisions and action with legislation or regulatory aspects, whether internal or external to the organization, such as: laws[41], legislations[42], regulatory matters, standards, policies, rules, customs (culture), among others. In other words, "to ensure regulatory compliance status" of business operations, e.g., keeping compliant with organizational policies, legislation, international standards, market rules. One of the founders at Lean IT Strategies claims: "*From a Lean perspective, traditional governance (in my mind this includes traditional budgeting, portfolio and program/project management practices) often introduce **wasteful "rules"** (explicit and implicit) that induce all sorts of counterproductive activities and behaviors such as gaming, suboptimal flow of information and decision making, siloization[43], localized metrics and rewards, overly complex and downright obfuscatory accounting and reporting rules, and so on*." - [NG03, 186:41]. Implying that ***compliance*** can be a moderator factor if the ability to properly handle with regulatory aspects was not addressed and developed by the team. In complement, an experienced Australian Consulting from IBM states: "*Many companies adopting agile delivery exist in industries that are heavily regulated by external and internal governing bodies... In these scenarios poor governance leads to **heavy fines** and **auditing costs**, and/or high vendor costs or poor outcomes. As software/technology becomes more and more an integral part of a company's reason for existence and channel to its customers, members, and suppliers governance, Risk, and **compliance becomes of even greater importance***." - [NG06, 190:14]. Inferring the ***growing importance of the compliance competency*** and the impacts caused by not treating it properly.

Governance competences are not detached from each and every. In fact, they should be developed and applied in combined and complementary way. Indeed, we have realized this fact in many references cited previously in this Section, as: Pardo and Burke (2008), Termeer et al.

[41] Laws are actually rules and guidelines that are set up by the social institutions to govern behavior. These laws are made by government officials that in some countries are elected by the public to represent their views. In simple terms, laws are basically things that a person can and cannot do, e.g., a civil code of a country. (OED, 2013)

[42] Legislation is another term meaning statutory law. These laws have been enacted by a legislature or the governing body of a country. Legislation can also mean the process of making the law, e.g., environmental legislation or labor legislation. (OED, 2013)

[43] The act or process of placing identical data into a multitude of separate electronic places or electronic containers, resulting in inefficiency of data altering and challenges with data consistency. (UD, 2015)

(2013), Xu and Kim (2014), Dubinsky et al. (2011) [S137], among others. For instance, when we returned to the Cheng et al. (2009) [S63] agile governance definition, we notice words as *accountability*, *responsibility* and *control mechanisms*. These ideas lead us to the establishment of a clear and transparent set of *roles*, *responsibilities*, *authority*[44] and the related **accountability**. For each ***business operation*** [B] element (product, service, process, project) is required the definition of whom: i) do the work to achieve (*responsible*); ii) the one ultimately answerable for the correct and thorough completion of the deliverable or task, and the one who delegates the work to those responsible (*accountable*, also approver or final approving authority); iii) those whose opinions are sought, typically subject matter experts, and with whom there is two-way communication (*consulted*, sometimes counsel); iv) hose who are kept up-to-date on progress, often only on completion of the task or deliverable; and with whom there is just one-way communication (*informed*).

Going beyond, we come to the concept of **traceability** that refers to the establishment of mechanisms for keeping track of a given set or type of information to a given degree, and allowing to perform a chronologically interrelation of uniquely identifiable entities in a way that can be verifiable. From a conventional approach we can reference them as the traditional mechanisms to monitoring and control, which adapted to the agile context, become *traceability mechanisms*, having as perspectives: *measure*, *metrics*, and *indicators*; as well as a strong relationship with the **accountability** dimension. However, *traceability* going beyond these basic issues and it allows the establishment of effective mechanisms (and metrics) to *ensure the accomplishment* of the *business strategy*, on several perspectives, such as: *accounting*, *auditing*, *quality* and *management*.

These capabilities can be considered relevant constituents of the "governance capabilities", boosting the validity related to this theory unit, because they aid to describe features, faculties or processes that can be developed or improved, which in its combination describe the nature of this construct, as well as they adequately express the patterns in the data which it purports to conceptualize.

Further details about the density of evidences found in every data collection source related to this theory unit, as well as an illustrative sample of the construct's nomological network, are available in APPENDIX V.1.

[44] Authority regards to the establishment of mechanisms whereby power is exercised and recognized in an organizational context. (United Nations, 2013a).

4.3.1.4.3 Methodological logic

This unit of the theory has the same properties of **agile capabilities [A]**, i.e., it is interpreted as an *associative* one, due both are dynamic capabilities that can be present only under certain circumstances (see Beginner Scenario (φ_0) in Section 4.5.3.1), even that in specific level of representativeness, or represented by different capabilities combination at distinct time period, before and after starting the theory application.

Regarding to Dubin's properties of units, governance capabilities is *variable*, because it may be present to a degree. This is *real* due to there is a high probability that empirical indicators exist. Further, it is *sophisticated* on account of it represent well defined unit, as well as it is *collective* because it describe an entire class or set of things.

4.3.1.5 Business operations [B]

4.3.1.5.1 Definition

This unit conceptualizes the set of *organized activities involved in the day to day functions of the business*, conducted for the purpose of generating ***value delivery***[45], including (but not limited to): processes, functions, services, products, projects, practices, and behaviors. These activities depend on the nature of the core business of the organization.

In turn, "**core business**" is the *raison d'être* of any organization, the cause of its existence. When the organization identifies its customers and recognizes which kind of benefit or value (by means of products and services) they are delivering to customers in order to achieve its institutional mission, they are addressing their core business. As a matter of fact, this concept can be applied for any kind of organization, for instance: in case of a **company** may be the target activity to achieve profit, for a **NGO**[46] might be a variety of service and humanitarian functions, concerning to **governments** should be initiatives to accomplish the welfare of its citizens.

Gradually, **business agility** has become an expression that is not restricted to the universe of for-profit organizations. In consonance with the proposed definition, we have distilled a new

[45] "An informal term that includes all forms of value that determine the health and well-being of the firm in the long run." (BD, 2013)

[46] "A non-governmental organization (NGO) is any non-profit, voluntary citizens' group which is organized on a local, national or international level." (NGO GLOBAL NETWORK, 2014)

definition to business agility as: "*the ability to deliver value faster, better, and cheaper to the core business*" (Luna et al., 2014b).

The prime goal of the ongoing theory is to help people (in an organizational context) to identify and address their emerging **disturbing** and **moderator** factors in order to take their **business operations** [B] to a level of **business agility**, aiming *maximizes its value delivery* to the *business* and their *beneficiaries* (shareholders, customers, citizens, etc.).

However, to achieve **business agility** baseline is easier than keep it (Caligiuri, 2013; Smith, 2012; Wang et al., 2014) [S32, S118, S135, S164, S166]. Hence, a dynamic balance between **sustainability** and **competitiveness** seems to form a perfect combination to allow **business operations** [B] must be able to maintain their productivity and balance of resources for a long term, at the same time while they must be able to be competitive in large range of circumstances (even adverse and turbulent), having successful in the persistence of the effects of their produced results, by means of **value delivery**.

Business operations [B] are articulated by **business processes** that describe the entire **value chain** of an organizational context. A value chain is an interlinked value-adding activities that convert inputs into outputs which, in turn, add to the bottom line and help create competitive advantage (Porter, 1985). In ITIL v3 (OGC, 2007a) *value chain* is described as a sequence of processes that creates a product or service that is of value to a customer. Each step of the sequence builds on the previous steps and contributes to the overall product or service. A value chain typically comprise: (1) **primary activities**, closely related to the core business; and, (2) **support activities**, assisting the primary ones. As usual example of the primary activities we would cite: (a) inbound distribution or logistics, (b) manufacturing operations, (c) outbound distribution or logistics, (d) marketing and selling, and (e) after-sales service. These activities are commonly supported by: (f) purchasing or procurement, (g) research and development, (h) human resource development, (i) and corporate infrastructure. The **Figure 3.5.B** depicts a didactical view about this classical view of value chain. However, as we have mentioned at the beginning of this Section the configuration of the **business operations** [B] and their respective **value chain** depend on the nature of the core business of the organization. For instance, for a software development firm we can cite as primary activities: (1) requirements elicitation, (2) product design, (3) software implementation, (4) software test, (5) software deployment, (6) software maintenance.

These activities ca be described in terms of ***business processes***, and grouped in macro-processes or depicted in sub-processes, activities and tasks, according to (ISO, 2008; OMG, 2011). In turn, to achieve better results these processes can adopt ***best practices*** from industry to generate and improve their ***outcomes***, by means of **products** and/or **services**. In complement, ***projects*** have usually become the means by which transformation occurs and changes are addressed on organizational context in order to achieve business objectives (Luna et al., 2010) [S60]. In spite of the nature of the business processes, best practices chosen to improve them, the projects that allow this improvement and evolvement, depend on the nature of the core business of every organizational context; these concepts (process, practice and project) are universal, and they can operate in a multitude of settings (in a combined and articulated manner) to establish and support the business operations in a large range of core business circumstances.

We will explore the concepts of *sustainability*, *competitiveness* and *business agility*, as well as describe their relations and effects over each other when we characterize the laws of interaction of the theory (Section 4.3.2) and their system states (Section 4.3.4). For now let's delve a little more on the concept of *business agility* that is the system state described by this theory where we wish to take the business operations [B].

4.3.1.5.2 Construct validity

Concerning to the theory unit validity, business operations is closely related to business agility, and other minor but associated concepts, such as: business process management (BPM) [S129, S134, S142], project management (PM) [S3, S39, S44, S98] and best practices from industry associated with quality management (QM) [S29, S31, S45, S47] and process improvement (PI) [S17, S75, S82], which vary according to each core business. For software industry we would mention, for instance: Software Process approaches, such as Scrum [S151, S160, S167] or XP [S123, S165]; or Software Processes Improvement (SPI) models such as CMMi [S5, S8, S75, S146], just to cite few.

The "business operations" emerged, from the triangulation among the data collection source of this study, as a category where fit several concepts related to the same pattern behavior: "*organized activities involved in the day to day functions of the business, conducted for the purpose of generating value delivery*". For instance:

(1) In keeping with Gurjar and Rathore (2013) [S144] business agility is about finding ways to wrap otherwise commodity products in a blanket of ***value added services*** that can be constantly tailored to respond to customers' changing needs. The authors go so far as to propose an "equation" to describe business agility, as: "Bring together above definitions we obtain new equation as – 'Business Agility = Rapid information access, analysis, decisions + Rapid business innovation + Rapid ***deployment of business capabilities*** + Rapid scaling of ***business operations*** up and down + Facile collaboration and access to resources + Security, compliance, ***business continuity***'."

(2) In addition, the IT manager from Brazilian Army Central Hospital highlights that "I think the big issue is IT be able to meet many possible changes that may occur with the business areas, giving agility with the new strategic guidelines." - [NG01, 184:1]. Implying the strategic alignment between IT and business areas as a means of achieve business agility.

(3) The Subject 1, an experienced Engineer and practitioner has claim during the interview: "*Business agility is about make decisions on business operations, then I think it's that thing with the decision quickly and... that decisions, this set of decisions that can guarantee the survival, the daily bread. Responsive governance would give autonomy to make decisions ... on time!*" - [IT01, 198:485-488]. This evidence illustrates the close relation that there is between ***decision making capability*** and ***business operations efficacy***.

This unit of the theory that represents "organized activities involved in the day to day functions of the business, in order to generate value delivery", was organized in the following dimensions, but not limited to them, such as:

- **Business processes:** related to the establishment, implementation and management of business processes to describe the entire value chain setting to the business operations, e.g., ensuring the reproducibility of business operations, supporting business goals, ensuring business continuity. Korhonen, Hiekkanen & Lähteenmäki (2009) [S23] points out that exemplary governance bodies and roles include line-of-business managers, middle-managers in IT units, ***process stewards*** and steering groups of implementation projects.

- **Project approach**: with respect to the establishment and implementation of *project life cycle* and project management approach for transitory aspects on business operations,

e.g., dealing with service transition, applying to change management, to produce new product/service, conducting business operations improvement. Bartenschlager & Goeken (2010) [S62] argue that Multi Project Management (MPM) is a technique of central importance to achieve the transfer of strategic plans to implementation, as projects are the central driver for change in organizations.

- **Best Practices:** regards to the identification, establishment and implementation of best practices from industry and academy, in order to improve business operations, e.g., allowing organizational learning, raising operation standards. Ambler & Lines (2013) [S122] point out that disciplined agile teams recognize that they are part of a larger, organizational ecosystem and act accordingly. Disciplined Agile Delivery (DAD) introduces primary roles of Architecture Owner (an agile solution architect) and Stakeholder to supplement the Scrum-like roles of Team Lead (ScrumMaster), Product Owner, and Team Member.

The term **business agility** is usually used as a synonym of **enterprise agility** or **organizational agility** and applied to designate a property of an enterprise to function in a highly dynamic world. As a result, agility became an important business issues. In addition, from different definitions of business agility, enterprise agility and organizational agility given by many authors, of which just to mention some [S106, S123, S129, S134, S135, S142, S144, S146, S149, S152, S157, S161, S164, S166], we distill some key concepts such as: *skill to response to environmental change, ability to cope with uncertainty, customer-based value, capacity to respond quickly and flexibly, competence to provide innovative responses, speed and dexterity, aptitude to adapt to environmental change*, among many others. Emerging from this universal set through the analysis of the essence for each key concept we condense the following *three key attributes* to business agility, namely: i) **sustainability**; ii) **competitiveness**; and, iii) **effectiveness**.

In the context adopted by this work **sustainability** must be interpreted as "*the property to be able to be maintained the harmony and productivity of the organizational context at a certain rate or level, conserving a balance by avoiding depletion of resources: time, team motivation and energy, etc".* Likewise, **competitiveness** is related to "*the ability to maintain the organizational context able to compete in any circumstances, especially in turbulent and dynamic environment*". Enhancing gradually the organizational ability to sense and respond to changes in competitive environments. Finally, effectiveness is about the degree to which

something is successful in producing a desired result, focusing not only on the effect of the income, but also in the persistence of this effect with respect to time.

These attributes can be considered relevant constituents of the "business operations", enhancing the validity associated to this theory unit, because they help to explain the nature of this construct, as well as they adequately express the patterns in the data which it purports to conceptualize.

Further details about the density of evidences found in every data collection source related to this theory unit, as well as an illustrative sample of the construct's nomological network, are available in APPENDIX V.1.

4.3.1.5.3 Methodological logic

This unit of the theory is *enumerative* because it is a property of the business that is always present. In other words, if the business has no operations, it cannot exist. The business operations are the engine (driving force) that maintains the business fulfilling its mission and addressing its core business.

Regarding to Dubin's properties of units, business operations is *variable*, because it may be present to a degree. This is *real* due to there is a high probability that empirical indicators exist. Further, it is *sophisticated* on account of it represent well defined unit, as well as it is *collective* because it describe an entire class or set of things.

4.3.1.6 Value delivery [R]

4.3.1.6.1 Definition

This unit conceptualizes the ability to generate results to the business by means of the delivery of value, which it includes all forms of value that determine the health and well-being of the organization in the long run. Further, these results must be expressed not only by delivery of products and services (which are outcomes from business operations [B]), but mainly by the persistence of the benefits arising from them (e.g., customer satisfaction, business efficacy, humanitarian aid, welfare of citizens), for a large spectra of audience that depends on every core business, such as: shareholders, customers, employees, partners, suppliers and societal.

In other words, no use the organizational context generates value whether it fails to deliver value to those who really need it. Organization should include in its planning, the respective activities to ensure value delivering to its audience.

Indeed, one of the most common reasons for the failure of a business attempt is its lack of ability to deliver value to its audience (Groth, 1994; Ravald and Grönroos, 1996). Probably it is because the concept of value can alone be defined by the audience, and it can include tangible and intangible concepts, such as perceptions and opinions (Koerner and Koerner, 1996; Lindgreen and Wynstra, 2005; Walters, 2012).

In a plain and brief explanation one of the components of the value delivery is "**utility**", which it means that whatever we are delivering to the audience has to be fit for the purpose that will be assigned to it by the customer, for instance. Essentially, for any product or service we deliver to a customer, having utility means that the customer can enhance the performance of their own assets, or remove some sort of constraint that prevents them from receiving more value from their assets (Thiry, 2008).

Another component is "**warranty**", which it means that the products or services that you deliver to your customer must be fit for use. Farther relevant aspect, in this case regarding to intangible aspect, to be addressed is to identify and overcome the barriers of the "**audience's perceptions**". The challenge for the organizational context is to identify these perceptions and determine the best way to present the service in a way that will convince the customer that this is the product or service that meets all of the requirements, real and perceived (Porter and Kramer, 2011).

In complement, a supplementary component of the value concept is the *stream of time* compatible with a satisfactory cost/benefit ratio, for every product or service, from the moment of conception until its availability for use, also known as: "**time-to-market**" (Brown, 2009).

In essence, we will stick to the tangible components to describe and test the behavior of this theory unit, because we need identify observable properties of the related constructs (empirical indicators) for the stage of theory testing. However, we must keep in mind that intangible aspects should not be ignored in the theory application, but for while they will not be focus of this work at this time. In short, **value delivery [R]** will be characterized in three dimensions: (i) **utility**: whether the outcomes are fit for purpose; (ii) **warranty**: whether they

are fit for use; (iii) **time-to-market**: whether they are available at the right time, in the right place, to the right people.

4.3.1.6.2 Construct validity

The concept of ***value delivery*** is a keystone of governance being notarized by academy and industry as follows. For instance, according to Barton (2013) [S128] this notion of '***value'*** is one of the key constructs supporting the concept of Lean thinking, which can be considered as a methodology that has its origins in the Toyota Production System (TPS) and whose principal objective is the creation of low cost improvements based on the reduction of waste [S90]. Moreover, in keeping with ITIL v3 (OGC, 2007a) and the COBIT 5 (ISACA, 2012) ***value delivery*** is the means by which we should ensure that IT-enabled investments can be managed through their full economic life cycle. Indeed, Makhlouf (2012) [S154] points out that in COBIT (ISACA, 2012) ***value delivery*** is one of the five basic principles that characterize the IT governance: strategic alignment, value delivery, performance measurement, resource management, and risk management.

In consonance with ITIL and COBIT, Qumer (2007) [S54] states that ***IT governance*** provides a mechanism for a strategic IT-business alignment to acquire maximum business value delivered by the consumption of IT resources. In addition, Dino, Dico and Midekso (2012), the service management paradigm improves return on investment (ROI), keeps risks low, profits high by fulfilling business agility and improved quality of service to the level of customer satisfaction and needs of an enterprise.

In favor of illustrate theory's unit validity, we present a sample from the many data patterns that we found from every source of theoretical sampling employed in this study. These evidences are related to the influence caused by the external environment on distinct organizational contexts, concerned to the behavior: "*the ability to generate results to the business by means of the delivery of value*". For instance:

(1) Gong and Janssen (2010) [S4] have introduced an approach to measure the process flexibility and agility in an ***e-government*** context. In our approach, six dimensions are introduced. The identification of those dimensions is a combination of qualitative and quantitative study. The former provides us the direction of measurement, which is the performance and cost aspect. The later makes them more precise by introducing dimensions that can be quantified. Those dimensions are 1) "throughput", 2) "***response***

time", 3) "law ***implementation time***", 4) "operational cost", 5) "law ***implementation cost***", and 6) "***quality***". Those dimensions can be measured using one or more metrics. Measurement is context dependent and the measure need to be operationalized for a certain situation.

(2) An experienced Software Engineer, from a Consulting firm on IT Governance in Rio de Janeiro-Brazil states "*Traditionally governance guides management... old management seeks for command and control, so old governance... to manage a lean-agile IT organization means to focus on frequent* ***value delivery*** *to the client organization, means to have plenty of collaboration and communication in an environment of multidisciplinary teams, means to eliminate waste, etc. So governance for the near future initiatives means more to guide managers in being lean than in defining processes and controls...*" - [NG03, 186:55]. Suggesting a ***lean-agile approach as an enabler*** to increase value delivery.

(3) ***Subject 3***, a senior Software Engineer, agilist and researcher on Agile Software Development, claims during interview: "*Agility is a new paradigm in fact, to deal with the software development and which has several principles for the optimization of these processes and to ... in order to* ***get more value faster*** *and more quality to the customer*." - [IT03, 200:82-85]. Supporting the ***close relation*** inferred by this work ***between agile approach and value delivery***.

The concept of ***business agility*** is intimately related to ***value delivery***. For instance, Yang and Liu (2012) [S166] points out that both (Dove, 1996) and (Fliedner and Vokurka, 1997) subsequently fragmented the concept of enterprise agility into four dimensions: (1) cost; (2) time; (3) quality; and (4) scope. We cannot forget the meaningful concept derived from "cost", namely ***cost-benefit ratio***, which expresses the stream to generate *value* by means of each *cost unit* consumed in this process. However, considering "cost" as concept implicit and strong related to the "*production capability*", we can infer that it is more greatly associated with ***business operations [B]*** than with ***value delivery [R]***.

Further, we can assume "time" concept is well represented by the dimension "time-to-market", the concept "scope" fine characterized by the dimension "utility" (fit for purpose), as well as the "quality" concept great described by both dimensions "warranty" (fit for use) and "utility". Hence, this construct was organized in the following dimensions, but not limited to them, such as:

- **Utility**: is related to the quality of practical use of products or services (outcome from business operations [B]) making them fit for purpose, making them for meet the audience desire among others. The ITIL glossary (OGC, 2007b) adds that utility is "***functionality*** *offered by a product or service to meet a particular need. Utility is often summarized as 'what it does'*.". In addition, (Menascé and Dubey, 2007) points out that utility functions allow stakeholders to ascribe a value to the ***usefulness*** of a system as a function of several attributes such as ***response time***, ***throughput***, and ***availability***. Chandra (2012) [S133] highlights that recent attention has shifted away from traditional e-Government to a new initiative Cloud Government (C-Government). According him cloud is the fusion of ***virtualization***, ***grid computing***, ***utility computing***[47] and ***web technologies*** resulting to a new ***IT service delivery*** mechanism that inherits the *agility* of *virtualization*, the *scalability* of grid computing and *simplicity* of Web 2.0. Moreover, Tallon (2008) [S106] discusses that, notwithstanding a rash of recent technological innovations in areas such as web services, utility computing and service-oriented architectures, a question remains as to whether an *absence of agility* or *adaptiveness* is primarily a ***technology rigidity*** issue or whether there are broader IT managerial issues that allow ***inflexible IT*** to persist and agility in turn to suffer. Suggesting ***technology rigidity*** as a ***moderator factor*** of the ***business operations*** [B], which in turn restrains the ***value delivery [R]***. Furthermore, ***Subject 5***, an experienced CEO from a Brazilian software company specialized in educational and social technologies, which develops software to Brazilian Government, reports during the interview: "*The degree of uncertainty I see much that the impact of it is management. When my team that's there producing the application that goes to the Ministry of Health... The degree of their uncertainty, it is very technical (related to the writing of the source code, technology) or related to the instability of requirements (customer influence) that affect the implementation of this or that functionality! Perhaps the impact the uncertainty is much higher when the customer takes the position of not paying [when it do not realize the usefulness/utility of the feature] and decide to cancel the project*" – [IT05, 202:529-537]. Conveying the idea how the ***uncertainty*** works as an ***external environmental factor [E]*** influencing the **business operations [B]** (software development processes: requirements elicitation, implementation), which in turn affect

[47] Utility computing is a service provisioning model in which a service provider makes computing resources and infrastructure management available to the customer as needed, and charges them for specific usage rather than a flat rate (Yeo et al., 2012).

the ***value delivery [R]***, by means of the ***jeopardizing of the software utility*** delivered to the customer, impacting the project success.

- **Warranty**: concerning to the quality of products or services are fit for use, keeping them available for use, ensuring the required performance, among others. ITIL (OGC, 2007b) describes warranty as "*a promise or guarantee that a product or service will meet its agreed requirements*" and as "*derived from the positive effect of being **available** when needed, in sufficient **capacity**, and **dependably** in terms of **continuity** and **security***." Mykityshyn and Rouse (2007) [S7] reports that warranty is also mentioned as an attribute of customer service layer. Customer and warranty analytics are normally part of the assessment, allowing monitor financial trends, costs, and revenues per customer, as well as service contracts and operations. O'Brien, Brebner and Gray (2008) [S9] claim that some of the main issues for organizations are dealing with *security*, ***performance***, *availability* and ***interoperability*** of their SOA-based systems. In addition, Heier, Borgman and Bahli (2012) [S145] advocate that some cloud adopters might fail to get basic data ***confidentiality***, ***integrity***, and ***availability*** (CIA) measures into place: encryption schemes to ensure that the shared storage environment ***safeguards all data***; robust access controls to ***prevent unauthorized data access***; and regular data backup with **safe storage**. Further, ***Subject 9***, an senior CEO of a Tele Health Center in Brazil, states when we have provoked her about the *lethargic behavior of exhausted teams:* "*Okay, but then you enter a question of systematization of work... then surely the issue of systematization is one of the things we always seek in the organization, when we wish continues to give a **guarantee of quality**, if we're **delivering that service with a quality** that people establish rhythm allowing that they are able to give the best of them without "overload" [sustainability], without overloading the mind and happen this scenario where you're putting [lethargic behavior of exhausted teams]. Although there are certain contexts where there are complications that in some point the we'll have to have a higher overhead for that particular team, that's where it is essential the issue of adaptability and flexibility. Flexibility and adaptability of how the team can return to the point of good productivity*." – [IT09, 206:503-514]. Suggesting the close relation between the ***value delivery*** stream, through ***maintaining the quality of service***, and the ***team resilience***.

- **Time-to-market**: is the length of time it takes from a product or service being conceived until its being available for sale. It is most important in industries where products are outmoded quickly (Afonso et al., 2008; Goldin et al., 2010). A common assumption is that *time-to-market* matters most for first-of-a-kind products or services (pioneers), but actually the leader often has the advantage of time, while the followers (settlers) are under the pressure of competitors (Brown and Lattin, 1994). In practical terms, this dimension regards to the development of mechanisms to reduce *time-to-market* of products or services, allowing quick releases, continuous improvement, among others (Mahmoud-Jouini et al., 2004a; Perols et al., 2013). Strang (2005) [S116] points out that the enterprise information systems ***must deliver outstanding*** customer experience, provide a rapid ***time-to-market*** and at the same time ***reduce our overall cost*** of ownership. Once the need for agile business processes is established, Deshmukh (2013) [S134] identifies key ***business process*** [B] design principles for also suggest briefly their inclusion in ***emerging markets*** [E]. According him, these financial touches upon how ***process engineering*** [B] and BPM technology, can ***deliver value*** [R] to these high growth markets in terms of low costs & short ***time-to-market*** new products & services, ***business managing risk*** & ***compliance*** [G] without losing ***competitive advantage***. Matt (2007) [S43] claims that a short ***time-to-market*** and consequently decreasing product lifecycles offer only ***narrow time frames*** (***timebox***) of opportunity for companies to *profitably* produce and sell a product (or service). An experienced agile and lean evangelist, working in Financial Services at a Global Bank (J.P. Morgan) in Singapore, shares in a professional network about his vision of agile governance and value delivery: "*A communication and **decision structure** across **agile teams** on items like architecture, UX, etc. whilst avoiding extra layers or hierarchy. Or integrating enterprise specialists in a **collaborative**, **just in time**, **just enough**, **non-hierarchical fashion**. In all cases aimed at getting the best business outcome in the current **timebox** and just enough looking ahead.*" - [NG03, 187:46]. Indicating how an *agile and lean approach* might help to ***reduce to time to deliver value*** to the business.

These dimensions are also aligned with the value delivery concept adopted by the most widespread governance frameworks such as ITIL and COBIT, and characterize properly the essence of this theory unit. The ITIL Service Strategy book (OGC, 2007c) describes utility and warranty as forming the basis of value for IT service consumers.

These attributes can be considered relevant constituents of the "value delivery", reinforcing the validity associated to this theory unit, because they help to explain the nature of this construct, as well as they adequately express the patterns in the data which it purports to conceptualize.

Further details about the density of evidences found in every data collection source related to this theory unit, as well as an illustrative sample of the construct's nomological network, are available in APPENDIX V.1.

4.3.1.6.3 Methodological logic

This unit of the theory is associative because it is a property of the business outcome that is present only under certain circumstances. For instance, an organizational context can generate outcomes, from its business operations [B], such as products or services, but it might not deliver value to its audience.

On the scenarios depicted about this ongoing theory (see Section 4.5.3) we always have considered that value delivery [R] have any value, even a likely low one. From those described scenarios, one that is closest to the possibility of a near-zero value delivery [R] is the Beginner Scenario (φ_0) (Section 4.5.3.1). However, we believe that there could be some scenarios where its value [R] can be null, although this discussion is beyond the scope of this work.

Regarding to Dubin's properties of units, business operations is *variable*, because it may be present to a degree. This is *real* due to there is a high probability that empirical indicators exist. Further, it is *sophisticated* on account of it represent well defined unit, as well as it is *collective* because it describe an entire class or set of things.

4.3.2 STEP 2: Laws of interaction

The laws of interaction describe the interactions that govern the theory, i.e., the synergy among the units of the theory and enable the researcher-theorist to answer the second theory development question: "*What are the laws of interaction of the theory*?"

The laws of interaction presented in this Section are statements of relationship that explain how the theory's units are connected, i.e., specify the relationships, or linkages, between the units. According to Dubin (1978), it is these relationships between units with which science is

centrally concerned; the scientist's objective is to account for the variance in one unit by specifying a systematic linkage of the unit with at least one other.

Table 4.4 – Type of Laws of interaction. Source: Adopted from (Dubin, 1978).

Type of Law	Description	Example	Considerations
Categoric	**Categoric** laws of interaction indicate that values of a unit of the theory are associated with values of another unit. A categoric law of interaction is one that maintains that the value of one unit is associated with values of another unit.	Words typically employed in this kind of law of interaction are "is associated with"; for example, "Unit A is associated with Unit B" (Dubin, 1978, p. 101). Within social and behavioral science theories, categoric laws are the most common from of laws of interaction (Dubin, 1978).	This type of law is common in the social sciences and indicates "a greater-than-chance probability that the units are related" (Dubin, 1978, p. 98). Categoric laws are **symmetrical** in nature, meaning that "it does not matter whether one or the other of the units comes first in the statement of the law" (Dubin, 1978, p. 100). Either one of units may come first in the statement of the law.
Sequential	**Sequential** laws are a second type of law of interaction and make use of a time dimension to describe the relationships between two or more units. Sequential laws of interaction employ a **temporal dimension**. This temporal dimension is used to order the relationship between the units involved.	An example of a sequential law would be "A community disaster activates an informal community leadership structure to organize a response to the disaster," (Dubin, 1978, p. 101). In this instance, a positive value for the unit disaster precedes the activation of informal leadership to respond. Words typically employed in this kind of law of interaction are succeeded by or preceded by; for example, "specified values of Unit A are succeeded by specified values of Unit B with a time interval of X" (Dubin, 1978, p. 103).	A sequential law of interaction therefore identifies a temporal interval between the values of two or more units and indicates that the relationship between the units concerned is unidirectional. As a result, sequential laws are **asymmetrical**, with a time lapse between the units being a characteristic of this type of law of interaction.
Determinant	A **determinant** law of interaction is one that relates determinate values of one unit of the theory with determinate values of another unit. For each determinate value of one unit there is a determinate value of the unit or units related to it (Dubin, 1978).	The most common language for articulating determinate laws is that of mathematics. These laws of interaction are typically used in the physical sciences where such precise relationships are more common than in the behavioral sciences (Dubin, 1978; Torraco, 2000).	According to Dubin, the most distinguishable feature of a determinate law is that "it may be drawn as a line, curve, plane, surface, a structure of linked points (as in graph theory), or matrices of fixed-position values (as in matrix algebra,)" (1978, p. 106). Determinant laws of interaction therefore describe specific relationships between units with determinate values (Dubin, 1978; Torraco, 2000).

Dubin labeled the systematic linkages among units within a theoretical model "*laws of interaction*." He specifically chose the term laws of interaction to "focus attention on the relationship being analyzed," (1978, p. 90). Dubin (1978) highlighted three general categories or types of laws of interaction, namely, *categoric*, *sequential*, and *determinant*. Those types are described in **Table 4.4**.

Table 4.5 – Laws of interaction: levels of efficiency. Source: Adopted from (Dubin, 1978).

Levels of efficiency	Description	Example	Considerations
Presence-absence	At the lowest level of efficiency, **presence-absence**, a law of interaction states that given the value of unit A, there will be a corresponding positive or negative value of unit B.	**Categoric laws** of interaction are always at the lowest level of efficiency, indicating a presence-absence relationship between the units of the theory. **Sequential laws** of interaction, on the other hand, "may achieve any level of efficiency" (Dubin, 1978, p. 111).	While presence-absence laws of interaction offer little information beyond concurrent presence (Tuttle, 2003), Dubin states that they are common in the social and behavioral sciences.
Directionality	At the next level of efficiency, **directionality**, laws of interactions describe the directionality of a relationship between two or more units.	Thus, at the level of directionality, a law of interaction may state that as unit X decreases unit Y will also decrease.	According to Dubin (1978), within the social and behavioral sciences, the ability to define a law of interaction at this level of efficiency is considered a significant advance in scientific precision.
Covariation	At the third level of efficiency, laws of interaction express **covariation**, i.e., correlated variation between the values of the units related.	For example, "Conformity to a standard of behavior in a fixed population varies in the shape of a J curve from absolute obedience," (Dubin, 1978, p. 110).	N/A
Rate of change	Finally, at the fourth and highest level of efficiency, **rate of change**, laws of interaction state that the direction and amount of change in one unit is correlated with a fixed direction and amount of change in another unit.	Boyle's Law states that when a sample of gas is compressed at constant temperature, the pressure P and volume V satisfy the equation PV=C, where C is constant (West, 1999).	Rate of change laws are most typical in the physical sciences where exact measurements are more feasible (Tuttle, 2003).

In addition to specifying the three categories of laws of interaction, Dubin (1978) indicated that a law of interaction may have four different levels of efficiency, each of which provides a different level of predictive power and understanding (Dubin, 1978; Tuttle, 2003). These levels of efficiency, depicted in **Table 4.5**, are of a cumulative nature and tend to correspond with the scientific sophistication of a specific scientific discipline.

Table 4.6 – Laws of interaction: logical rules. Source: Adopted from (Dubin, 1978).

Rule	Description
Inconsistency	"Two laws cannot relate two units of a system with *inconsistent results*. Either of the two laws must be discarded," (Dubin, 1978, p. 112).
Minimum	"A system has a minimum of *one law of interaction*," (Dubin, 1978, p. 112).
Maximum	"The *maximum number of laws of interaction* for a system of '*n*' units is the number of laws necessary to relate the units two at a time each once with all the other units," (Dubin, 1978, p. 113).
Mixing	"A system may have categoric, sequential, and determinate laws governing interaction among its units. *There is no logic limiting the mixture of types of laws* in the same model provided each type employed meets the criteria for its class," (Dubin, 1978, p. 113).
Intra-level	"In relation to levels of analysis, laws of interaction are always *intra-level in location*," (Dubin, 1978, p. 121).

The higher the level of efficiency reflected in the laws of interaction, that is, presence-absence, directionality, covariation, or rate of change, the more sophisticated and complex the laws of interaction are considered to be. In addition, Dubin (1978) articulated several logical rules which govern the laws of interaction within a given theory. Those rules are depicted in **Table 4.6**.

The Section presents the six laws of interaction for this theory. **Table 4.7** depicts a summary with the statement and classification, according Dubin's Framework, of each law of interaction of this theory.

Table 4.7 – Theory's laws of interaction: summary of classification. Source: Adopted from (Dubin, 1978).

ID	Law title	Lawful statement	Type of law	Suggested Level of efficiency
L1	Agile governance	Agile governance arises when agile capabilities [A] are combined coordinately with governance capabilities [G], activating or intensifying an increase in the level of business operations [B], which in turn increases the value delivery [R]	[ ] Categoric [X] Sequential [ ] Determinant	[ ] Presence-absence [X] Directionality [ ] Covariation [ ] Rate of change
L2	Specific agile approach	An specific agile approach arises when agile capabilities [A] are applied in different aspects of the organizational context, which are not governance capabilities [G], activating or intensifying an increasing in business operations [B], which in turn increases the value delivery [R].	[ ] Categoric [X] Sequential [ ] Determinant	[ ] Presence-absence [X] Directionality [ ] Covariation [ ] Rate of change
L3	Effects of moderator factors	There are internal moderator factors whose effects [M] can inhibit or restraining the agile capabilities [A] and governance capabilities [G], or even reduce business operations [B], which in turn decreases the value delivery [R].	[ ] Categoric [X] Sequential [ ] Determinant	[ ] Presence-absence [X] Directionality [ ] Covariation [ ] Rate of change
L4	Effects of environmental factors	There are environmental factors whose effects [E] can disturb the organizational context, influencing: the effects of moderator factors [M], agile capabilities [A], governance capabilities [G] and business operations [B], which in turn affects in some level the value delivery [R].	[ ] Categoric [X] Sequential [ ] Determinant	[ ] Presence-absence [X] Directionality [ ] Covariation [ ] Rate of change
L5	Sustainability &	The combined and coordinated coupling of	[ ] Categoric	[ ] Presence-absence

ID	Law title	Lawful statement	Type of law	Suggested Level of efficiency
	Competitiveness (Countermeasures)	agile capabilities [A] and governance capabilities [G] reduces the effects of environmental factors [E] and the effects of moderator factors [M] upon the organizational context, contributing to decreases the inhibition, restriction or disturbing on organizational context, and decreasing their harmful effects upon business operations [B] over time, which in turn increases the value delivery [R].	[X] Sequential [ ] Determinant	[X] Directionality [ ] Covariation [ ] Rate of change
L6	Value delivery	Influence on business operations [B] will generate directly proportional effects on value delivery [R].	[ ] Categoric [X] Sequential [ ] Determinant	[ ] Presence-absence [X] Directionality [ ] Covariation [ ] Rate of change

The discussion of each law of interaction follows a similar format. Each law is *defined*, its *rational for inclusion* in the theory discussed, and the *methodological logic* of the law presented.

4.3.2.1 Law 1: Agile Governance

4.3.2.1.1 Definition

The first law of interaction in the Agile Governance Theory makes explicit the linkage between three units of the theory: *agile capabilities* [A], *governance capabilities* [G], and *business operations* [B]. At the same time, this law suggests the consequence of the interactions among those units on a fourth unit, namely, *value delivery* [R]. Specifically, the law states:

> **1st Law**: "*Agile governance arises when agile capabilities [A] are combined coordinately with governance capabilities [G], activating or intensifying an increase in the level of business operations [B], which in turn increases the value delivery [R]".*

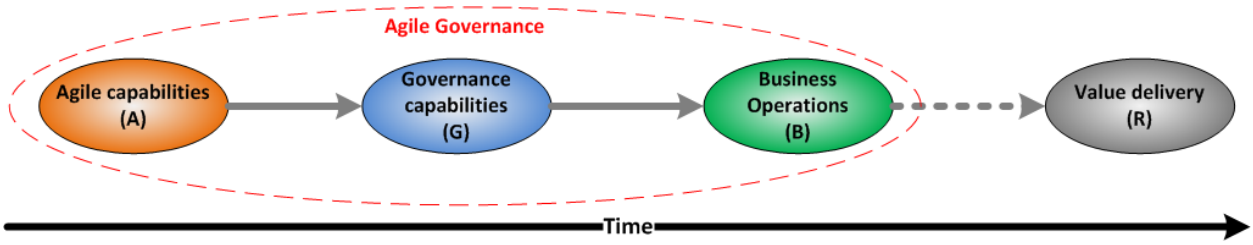


Figure 4.3 – Law 1: Agile Governance. **Source:** Own elaboration.

The **Figure 4.3** depicts the interactions of the units, as stated by the first law. The dashed arrow does not belong to the law under characterization, only the solid arrows. At the bottom of the

figure, we can see the arrow representing the time dimension, indicating the temporal sequence of events described by the law. In other words, as a reference: the events leftmost occur before than the events that are placed on the right side.

4.3.2.1.2 Rationale

The rationale for Law 1 has two parts. The first part of this rationale supports the link between *agile capabilities* [A] and *governance capabilities* [G]. The second part supports the link between *governance capabilities* [G] and *business operation* [B]. Each part is discussed in turn.

In addition, the Law 1 describes that *governance capabilities* [G] works as a mediator variable, between the application of *agile capabilities* [A] to cause effect on *business operations* [B], in order to raise [B] to a state of *business agility* (let's dig into this effect later, when we will discuss the theory system states, in Section 4.3.4). In other words, according to the Law 1: *"[A] causes effect on [B], by means of [G]*". This first effect between the interaction of [A] and [G] is what describes the **first part** of Law 1.

As previously described *agile capabilities* [A] have been helped people and organizations to achieve better results through several specific approaches, such as: agile software development [S73], agile project and portfolio management [S122], agile manufacturing [S10], and agile enterprise [S31] among others. However, the application of their enabling property together with *governance capabilities* [G], and its consequent benefits, is still a practice in consolidation by industry and academy, as pointed out by the review described in Chapter 3.

On the other hand, agility at the business level demands capabilities such as flexibility, responsiveness and adaptability, which should be applied upon *governance capabilities* [G] such as policy making, decision making, accountability, control and responsibilities, generating new and innovative approaches such as: agile policy making [S153], agile decision making [S131], lean public services [S93], etc. This resultant hybrid approach is the result of the first part of the Law 1, and it seeks to achieve effective and responsive sense of coordination across several organizational contexts (e.g., teams, projects, multiple business units, whole enterprise, or even multi-organizational setting), especially in competitive environments.

Under this context, arises the agile governance phenomena by means of the application of *agile capabilities* [A] upon *governance capabilities* [G] as the link between the decision-making

ability, the willingness strategic, and the competence to put into practice these tactics concretely to improve *business operations* [B] (raising and translating them in terms of *business agility*, which can be considered a system state of business operations: we will deepen this topic in Section 4.3.4), as well as the expand the understanding of how these arrangements can help the organizations to attain greater enterprise agility and support its overall strategy. Particularly, the interaction between the resultant effects of the first part of Law 1 [A→G] into [B] is what we name the **second part** of that Law.

In fact, there will be the cases where the organization context already has any level of *business agility*, on its *business operations* [B], reached by means of some of those specific agile approach mentioned in Section 3.7.2 (See also next Section: Law 2). In those cases, the first law highlights that the increasing (performance) of *business operations* [B], turning into business agility, should be intensified. Otherwise, if there was no prior agile experience on the organizational context, it must be activated by means of the Law 1.

Consequently, an increasing in *business operations* [B] will reduce gradually the *time* of *delivering value* [R], improve the *quality* of *delivering value* [R], and finally reduce the *cost* of *delivering value* [R] by the organizational context.

4.3.2.1.3 Methodological logic of the law

Law 1 is a *sequential law of interaction* at the *second level of efficiency*. The sequential nature of the law is apparent from the inclusion of a *time dimension*. The law indicates that a given value for *agile capabilities* [A] when is applied upon *governance capabilities* [G] occurs prior to an increase in *business operations* [B], which in turn occurs prior to an increase in *value delivery* [R].

Laws at *second level of efficiency* describe the *directionality* of a relationship between two or more units. In accordance with this definition the first Law describes the *directionality* of the relationship between the units: *agile capabilities* [A], *governance capabilities* [G], *business operations* [B], and their indirect influence in *value delivery* [R].

4.3.2.2 Law 2: Specific Agile approach

4.3.2.2.1 Definition

The second law of interaction in the theory elucidates the interaction between two units of the theory: *agile capabilities* [A] and *business operations* [B]. At the same time, this law suggests the consequence of the interactions among those units on a third unit, namely, *value delivery* [R]. Particularly, the law states:

> **2nd Law**: "*An specific agile approach arises when agile capabilities [A] are applied in different aspects of the organizational context, which are not governance capabilities [G], activating or intensifying an increasing in business operations [B], which in turn increases the value delivery [R]".*

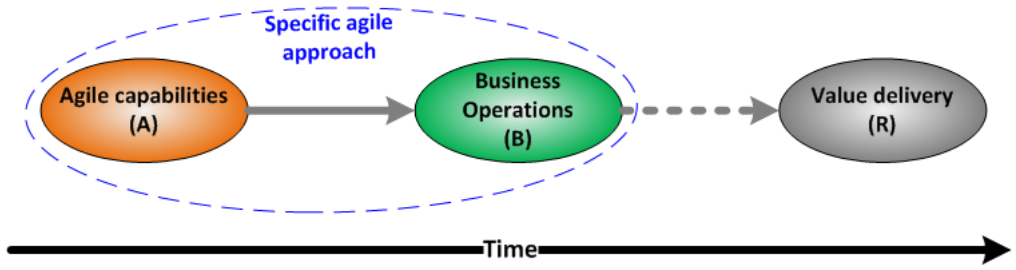


Figure 4.4 – Law 2: Specific agile approach. Source: Own elaboration.

The **Figure 4.4** depicts the interactions of the units, as stated by the second law.

4.3.2.2.2 Rationale

As previously mentioned during the rationale of Law 1, the Law 2 describes a chronologically previous one and widely known phenomenon, which is specific application of *agile and lean capabilities* [A] upon *business operations* [B] in order to influence positively the generation of *value delivery* [R] to the business. Indeed, as found abundantly in scientific and industry literature, this phenomenon can occur in the form of several approaches, such as: agile software development [S80], agile project and portfolio management [S103], agile manufacturing [S28], and agile enterprise [S129] among others.

This specific agile approach can contribute positively to lead business operations [B] to a state of *business agility*, by means of application of capabilities such as *flexibility* and *agility* [A] on *software development* [B], reducing the challenges of software engineering, improving quality,

aligning business and IT [S160]. Or also, when occurs a purposeful application of *lean approaches* [A] in agile *software development* [B], where *lean approaches* [A] are applied to the business areas related to *software development* [B], while agile within, lean out-reach: using lean approaches to interact with neighboring business units while keeping agile development processes internally, which can create involvement of neighboring units, for example, service and delivery units, product management, market units and customers [S165]. Or even, in case of adoption of *agile capabilities* [A] by the *enterprise operating platform* [B], in order to generate an integrated infrastructure for agile enterprise, extending some new operating conceptions of enterprises, such as *Agile Manufacturing Enterprise* and *Agile Supply Chain* (Su, 2012).

In all these instances, as result of Law 2, there is an increasing in *business operations* [B] will reduce gradually the *time* of *delivering value* [R], improve the *quality* of *delivering value* [R], and finally reduce the *cost* of *delivering value* [R] by the organizational context. However, we advocate that these effects from Law 2 should be less strong than the effects of the Law 1.

We would infer Law 2 behavior in the presence of Law 1 as: "*when the agile governance approach [Law 1] reaches its maximum effect, then the specific agile approach [Law 2] is assimilated (incorporated) by the prior one in the organizational context, and, this former one, losing its meaning (raison d'être)*".

In other words, under this condition, is as if the Law 1 incorporates the Law 2, generating a unified effect: agile governance approach. We can suggest that, after Law 1 has reached its maximum performance, there is no point in an isolated application of agility [A] without coordination that governance capabilities [G] can provide to the organizational context, because this context is already at an advanced stage of organizational awareness, for which this specific approach [Law 2] does not add value.

4.3.2.2.3 Methodological logic of the law

Law 2 is, also, a *sequential law of interaction* at the *second level of efficiency*, because of the relevance of the *time dimension* in its operating. The law indicates that a given value for *agile capabilities* [A] when is applied upon *business operations* [B], occurs prior to an increase in *value delivery* [R].

Further, the second Law describes the *directionality* of the relationship between the units: *agile capabilities* [A], *business operations* [B], and their indirect influence in *value delivery* [R].

4.3.2.3 Law 3: Effects of moderator factors

4.3.2.3.1 Definition

The third law in the theory describes the interaction between four units of the theory: *internal moderator factors effects* [M], *agile capabilities* [A], *governance capabilities* [G], and *business operations* [B]. In meantime, it is also possible imply the indirect effects from [M] on a fifth unit namely *value delivery* [R]. Mainly, the law states:

> **3rd Law**: *"There are internal moderator factors which effects [M] can inhibit or restraining the agile capabilities [A] and governance capabilities [G], or even reduce business operations [B], which in turn decreases the value delivery [R]".*

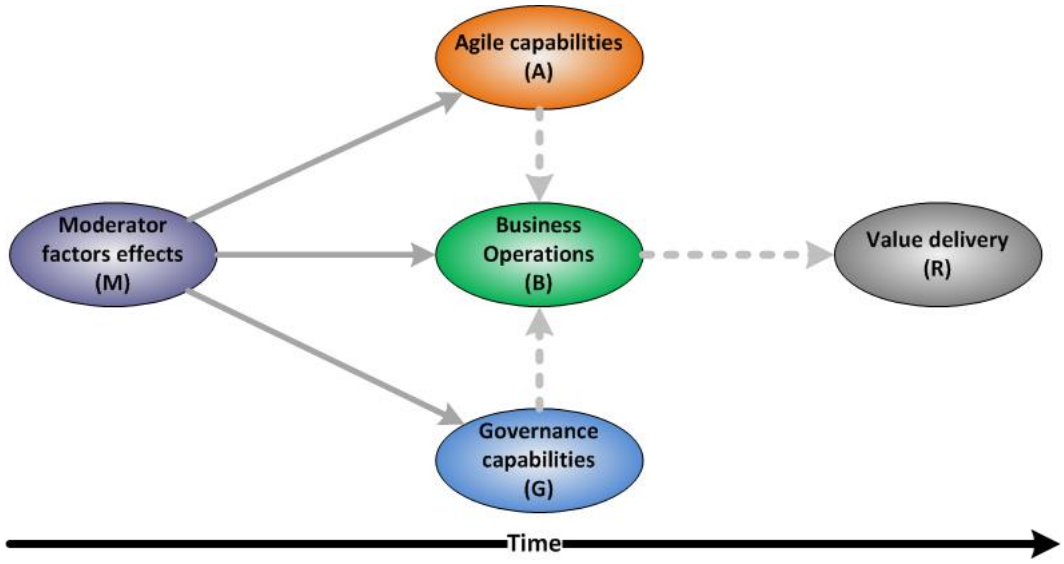


Figure 4.5 – Law 3: Effects of moderator factors. Source: Own elaboration.

The **Figure 4.5** depicts the interactions of the units, as stated by the third law. The dashed arrows do not belong to the law under characterization, only the solid arrows. At the bottom of the figure, we can see the arrow representing the time dimension, indicating the temporal sequence of events described by the law. In other words, as a reference: the events leftmost occur before than the events that are placed on the right side.

At the same time, beyond the direct interactions described by this law ([M]→[A], [M]→[G], [M]→[B]), this law also suggests the *consequences of the these direct interactions* (indirect effects depicted by dashed arrows in **Figure 4.5**) that are described by other laws (or influence them), e.g., the restraining effects of [M] upon [A], has impact on the Law 1 and Law 2.

4.3.2.3.2 Rationale

The rationale for Law 3 is organized in three parts. Part one supports the link between *moderator factors effects* [M] and *agile capabilities* [A]. Part two supports the link between *moderator factors effects* [M] and *governance capabilities* [G]. Finally, part three supports the link between *moderator factors effects* [M] and *business operations* [B]. Each part will be discussed in turn.

The **part one** of the Law 3 is characterized by the influence of the effects from moderator factors [M] existing into the organizational context that can hinder the development of agile capabilities [A]. For instance, the influence of a *refractory organizational culture* upon the fostering of *self-organization* in a software development team, causing the team *trust becomes shaken* [S127].

Part two of the Law 3 is depicted by the impact of the effects from moderator factors [M] existing into the organizational context that can hinder the development of governance capabilities [G]. For example, the establishment of a proper *accountability mechanism* jeopardized by a *refractory organizational culture*, in order to avoid generates an *oppressive organizational climate* (make the organizational culture even more damaging/harmful) [S132].

In turn, **part three** of the Law 3 is expressed by the repercussion of the effects from moderator factors [M] existing into the organizational context, such as refractory *organizational culture* that can restraining the business operations [G], such as *agile software development*. A harmful organizational culture can jeopardize the team cohesion, making the team miss delivery times or even compromising software quality produced [S160].

It is important realize that the effects caused by each interaction (link) described by this law, add up and spread through the effect that this law has on the overall system described by this theory.

4.3.2.3.3 Methodological logic of the law

Law 3 is a sequential law of interaction at the second level of efficiency, due of the importance of the time dimension in its operating. For instance, the law indicates that a given value for *moderator factors effects* [M] when is applied upon *agile capabilities* [A], *governance capabilities* [G] and *business operations* [B], occurs prior to a decreasing in value delivery [R].

Furthermore, the third Law describes the directionality of the relationship between the units: *moderator factors effects* [M], *agile capabilities* [A], *governance capabilities* [G], *business operations* [B], and their indirect influence in *value delivery* [R].

4.3.2.4 Law 4: Effects of environmental factors

4.3.2.4.1 Definition

The fourth law of interaction in the theory clarifies the linkage between five units of the theory: *effects of environmental factors* [E], *effects of moderator factors* [M], *agile capabilities* [A], *governance capabilities* [G], and *business operations* [B]. In meantime, it is also possible imply the indirect effects from [E] on a fifth unit namely *value delivery* [R]. Mainly, the law states:

> **4th Law**: "*There are environmental factors which effects [E] can disturb the organizational context, influencing: the effects of moderator factors [M], agile capabilities [A], governance capabilities [G] and business operations [B], which in turn affects in some level the value delivery [R]".*

The **Figure 4.6** depicts the interactions of the units, as stated by the fourth law. The dashed arrows do not belong to the law under characterization, only the solid arrows. At the bottom of the figure, we can see the arrow representing the time dimension, indicating the temporal sequence of events described by the law. In other words, as a reference: the events leftmost occur before than the events that are placed on the right side.

At the same time, beyond the direct interactions described by this law ([E]→[M], [E]→[A], [E]→[G], [M]→[B]), this law also suggests the *consequences of the these direct interactions* (indirect effects depicted by dashed arrows in **Figure 4.6**) that are described by other laws (or influence them), e.g., the disturbing effects of [E] upon [M], has impact on the Law 3.

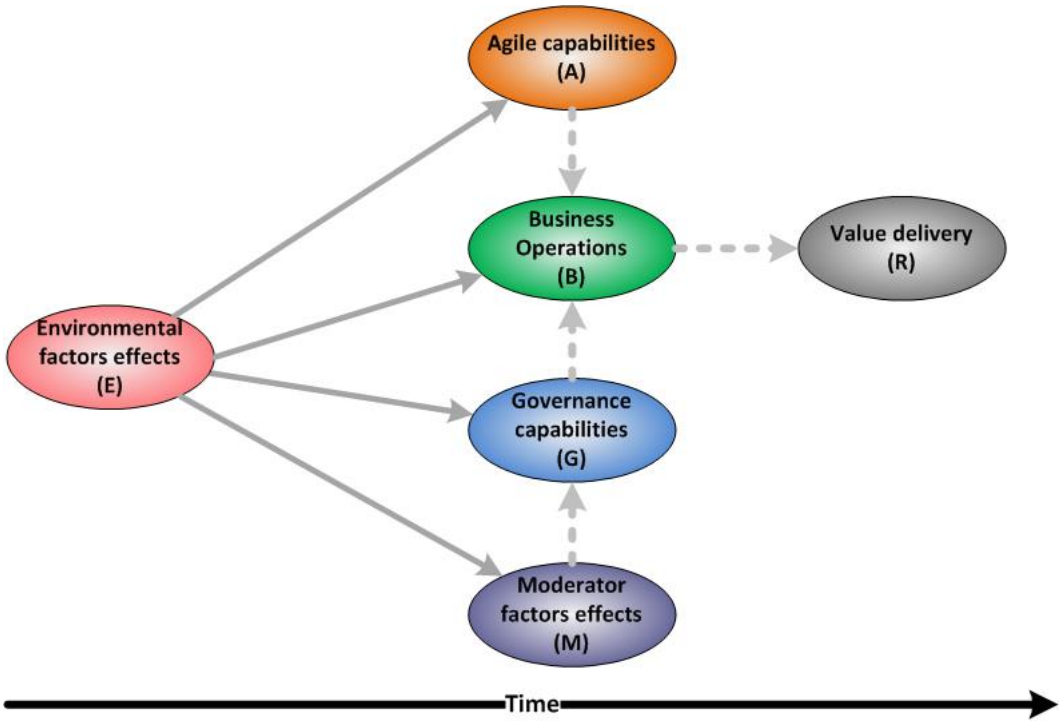


Figure 4.6 – Law 4: Effects of environmental factors. Source: Own elaboration.

4.3.2.4.2 Rationale

The rationale for Law 4 is organized in four parts. Part **one** supports the link between *effects of environmental factors* [E] and *moderator factors effects* [M]. Part **two** supports the link between *effects of environmental factors* [E] and *agile capabilities* [A]. Part **three** supports the link between *effects of environmental factors* [E] and *governance capabilities* [G]. Finally, part **four** supports the link between *effects of environmental factors* [E] and *business operations* [B]. Each part is discussed in turn as follows.

The **part one** of the Law 4 is characterized by the influence of the *effects of environmental factors* [E], in which the organizational context resides, upon the existing inner moderator factors [M], which can result in the potentiation of the [M] effects in the organizational context. For instance, in a *turbulent and competitive environment* [E] the harmful impact of *inadequacy of leadership* [M] is even more damaging to the organizational context, as discussed in [S7].

Part two is explained by the influence of the *effects of environmental factors* [E] upon agile capabilities [A], which can disturb development of these capabilities [A] in the organizational context. For example, a period of *economic instability* [E] experienced by the organization where a project resides can jeopardize the development of *cooperation* and *collaboration*

essential components for *team responsiveness* [A], because the team members are feeling insecure (shaken confidence) and they are afraid of losing their jobs [S127].

The **third part** of the Law 4 is described by the influence of the *effects of environmental factors* [E] upon governance capabilities [G], which can disturb development of these capabilities [G] in the organizational context. For instance, the *influence of regulatory institutions* [E] can generate some *legislation impact* [E] that can jeopardize the development of *compliance capability* [G] related to the establishment of roles, essential component for *accountability mechanisms* [G], as implied in [S142].

In turn, **part four** of this law is expressed by the repercussion of the *effects of environmental factors* [E] upon *business operations* [B], which can disrupt business efforts in the organizational context. For example, the *technological impact* [E] generated by the chosen of a *novice technology* can reduce the *software development productivity* [B], because the team members would not be experienced in this technology, or/and it can generate some *technical debt* in the software product, as suggested in [S167].

We would like to reinforce that the effects caused by each interaction (link) described by this law, add up and spread through the effect that this law has on the overall system described by this theory.

4.3.2.4.3 Methodological logic of the law

This is a sequential law of interaction at the second level of efficiency, by reason of the importance of the time dimension in its operating. For instance, the Law 4 predicts that a given value for *effects of environmental factors [E]* when is applied upon *moderator factors effects* [M], *agile capabilities* [A], *governance capabilities* [G] and *business operations* [B], occurs prior to a decreasing in *value delivery* [R].

Moreover, the fourth Law describes the directionality of the relationship between the units: *effects of environmental factors [E]*, *moderator factors effects* [M], *agile capabilities* [A], *governance capabilities* [G], *business operations* [B], and their indirect influence in *value delivery* [R].

4.3.2.5 Law 5: Sustainability and competitiveness

4.3.2.5.1 Definition

The fifth law of interaction in the theory elucidates the relation between four units of the theory: *agile capabilities* [A], *governance capabilities* [G], *effects of environmental factors* [E], and *effects of moderator factors* [M]. As a result, this law suggests the consequence of the interactions among those units on a two other units, namely, respectively *business operations* [B] and *value delivery* [R]. Specifically, the law states:

> **5th Law**: "*The combined and coordinated coupling of agile capabilities [A] and governance capabilities [G] reduces the effects of environmental factors [E] and the effects of moderator factors [M] upon the organizational context, contributing to decreases the inhibition, restriction or disturbing on organizational context, and decreasing their harmful effects upon business operations [B] over time, which in turn increases the value delivery [R]".*

The **Figure 4.7** depicts the interactions of the units, as stated by the fifth law. The dashed arrows do not belong to the law under characterization, only the solid arrows. At the bottom of the figure, we can see the arrow representing the time dimension, indicating the temporal sequence of events described by the law. In other words, as a reference: the events leftmost occur before than the events that are placed on the right side.

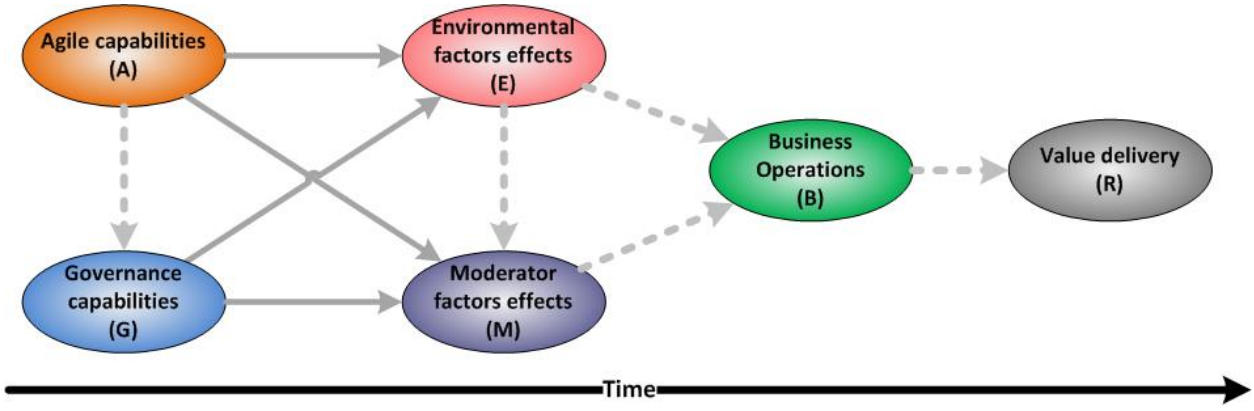


Figure 4.7 – Law 5: Sustainability and competitiveness. Source: Own elaboration.

At the same time, beyond the direct interactions described by this law ([A]→[E], [A]→[M], [G]→[E], [G]→[M]), this law also suggests the *consequences of the these direct interactions*

(indirect effects depicted by dashed arrows in **Figure 4.7**) that are described by other laws (or influence them), e.g., the steering effects of [G] upon [M], has impact on the Law 3.

4.3.2.5.2 Rationale

The Law 5 is activated only after the establishment of the Law 1, and when the organizational context already can provide coordinately a continuous flow for combined development of both agile capabilities [A] and governance capabilities [G].

The rationale of Law 5 is depicted in two parts. Part **one** supports the interactions between both *agile capabilities* [A] and *governance capabilities* [G] and their influence on the *effects of environmental factors* [E]. While part **two** supports the interactions between both *agile capabilities* [A] and *governance capabilities* [G] and their influence on the *effects of moderator factors* [M]. Each part will be discussed in turn.

The **part one** of the Law 5 is characterized by the influence of both *agile capabilities* [A] and *governance capabilities* [G] upon the *effects of environmental factors* [E], which can result in the reduction of the [E] effects on the organizational context. For instance, when US Supply Services applies agility and adaptability [A] on decision making chain [G] aiming become its business operations [B] (contracts and procurement) more responsive and flexible, they can reduce the economic effect of a single supplier and from commodities market [E] on its supply chain, assuring the effectiveness of the logistics [R] to the US military services [S148].

In turn, **part two** of the fifth Law is depicted by the influence of both *agile capabilities* [A] and *governance capabilities* [G] upon the *effects of moderator factors* [M], which can result in the decreasing of the [M] effects on the organizational context. For example, when Her Majesty's Courts Service (HMCS), an executive agency of the Ministry of Justice (MoJ) from UK Government, applies lean capabilities [A] upon control mechanisms [G] to simplify and redesign the business processes [B], in order to improve internal efficiency of customer service [R], by means of the enhancing the enterprise architecture [M] [S162].

The Law 5 is named "Law of the Sustainability and Competitiveness" because it is closely related with these concepts, as follows:

- **Sustainability**: When the coordinated combination of both [A] and [G] is applied upon [M] (part two), it is done in order to reduce any inner effect from organizational context

that can restraining or inhibit its performance. Thus, this approach allows maintaining organizational context harmony and productivity at a certain grade, conserving a balance by avoiding depletion of resources (e.g., time, team motivation and energy, etc.) for a long term.

- **Competitiveness**: When the coordinated combination of both [A] and [G] is applied upon [E] (part one), it is done in order to reduce any external effect from the environment where the organizational context is placed, which can disturb or disrupt its performance. Hence, this approach allows maintaining the organizational context able to compete in a large range of circumstances, especially in turbulent and dynamic environments. As a result this approach enhances gradually the organizational ability to sense and respond to changes in competitive environments.

4.3.2.5.3 Methodological logic of the law

Law 5 is a sequential law of interaction at the second level of efficiency, because of the relevance of the time dimension in its operating. For instance, this law states that a given value for both *agile capabilities* [A] and *governance capabilities* [G] when is applied upon *effects of environmental factors [E] or moderator factors effects* [M], occurs prior to an increasing of and *business operations* [B] and the respective increment in *value delivery* [R].

Moreover, the fifth Law characterizes the directionality of the relationship between the units: *agile capabilities* [A], *governance capabilities* [G], *effects of environmental factors [E]*, *moderator factors effects* [M], and their indirect influence in *business operations* [B] and *value delivery* [R].

4.3.2.6 Law 6: Value delivery

4.3.2.6.1 Definition

The fifth law of interaction in the theory clarified the relation between two units of the theory: *business operations* [B] and *value delivery* [R]. Specifically, the law states:

> **6th Law**: "*Influence on business operations [B] will generate directly proportional effects on value delivery [R]".*

The **Figure 4.8** depicts the interactions of the units, as stated by the sixth law. At the bottom of the figure, we can see the arrow representing the time dimension, indicating the temporal sequence of events described by the law. In other words, as a reference: the events leftmost occur before than the events that are placed on the right side.

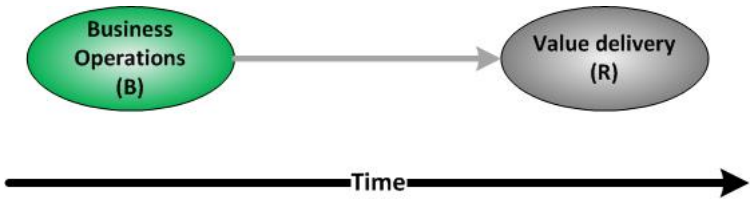


Figure 4.8 – Law 6: Value delivery. Source: Own elaboration.

4.3.2.6.2 Rationale

This sixth law receives as input the resultant effect of every law of this theory and their influence upon *business operations* [B], and relays their consequences on *value delivery* [R].
The rationale of Law 6 is pretty simple, and supports the interaction between *business operations* [B] and *value delivery* [R]: the resulting effect of all influences upon business operations [B] will generate a direct and proportional effect on value delivery [R].

However, it does not mean that each and every influence exerted upon [B] will cause effect on [R], for each one interaction, but only for the resulting effect of accounting for all effects received by [B] during a time period (persistence).

4.3.2.6.3 Methodological logic of the law

The sixth is a sequential law of interaction at the second level of efficiency, on account of the pertinence of the time dimension in its operating. For example, the Law 6 states that a given value for *business operations* [B] occurs prior to the respective influence upon (increment or decrement in) *value delivery* [R].

Besides, the sixth Law characterizes the directionality of the relationship between the units: *business operations* [B] and *value delivery* [R].

4.3.3 STEP 3: Boundaries of the theory

Theories are intended to model some element of the real world. The boundaries of a theory identify which aspects of the real world the theory is attempting to model and which it is not (Lynham, 2002a). Thus, the boundaries of a theory delineate the domains or territory over which the theory is expected to hold true (Dubin, 1978).

This Section presents the boundaries of the theory. The boundaries presented serve to identify the domain over which "Agile Governance Theory" applies. Thus, the output of this Section addresses the question, "*What are the boundaries of theory?*". This Section describes the boundary-determining criteria for this theory.

A theory is said to be bounded when the limiting values on the theory's units are understood (Dubin, 1978). Moreover, boundary-determining criteria apply with equal force to both a theory's units and the laws of interaction that relate these units (Dubin, 1978). Both units and laws must comply to the theory's boundary-determining criteria before the theory is complete, (Dubin, 1978).

The criterion of homogeneity requires that "*the units employed in the theory and the laws by which they interact satisfy the same boundary-determining criteria*" (Dubin, 1978, p. 127). Dubin (1978) further specified that "*a theoretical model*[48] *is said to be bounded when the limiting values on the units comprising the model are known. The limiting values are always determinate*" (p. 126). In comparing the output of this third theory development step with the corresponding boundary-determining criteria, it is important to first clarify some basic related concepts, namely, *boundary criteria*, *interior boundary-determining criteria*, and *external boundary-determining criteria*. These concepts are depicted in **Table 4.8**.

Table 4.8 – Theory's boundary basic concepts. Source: Adapted from Dubin (1978).

Homogeneity criteria	Description
Boundary criteria	"The boundary-determining criteria [of a theory]," said Dubin (1978), "apply with equal force to the units employed and the laws of interaction among these units. The units [of a theory] must fit inside the boundaries before [the theory] is complete" (pp. 126-127).
Interior boundary-determining criteria	Internal boundary-determining criteria are those that are "derived from the characteristics of the units and the laws employed [in the theory]" (p. 128).
External boundary-determining criteria	External boundary-determining criteria, on the other hand, "are those imposed from outside [the theory]" (p. 132).

[48] According to Dubin (1978), the theoretical model is a form to represent the system described by the emerging theory.

For instance, Dubin (1978, p. 136) give us a illustrative example of the boundary criteria when exemplify "*if maleness is the initial criterion, then the addition of a second criterion like adolescence will further restrict the domain to the age range represented by adolescence. Maleness plus adolescence has a narrower domain than either one alone*".

The number of boundary-determining criteria also has an influence on the homogeneity of the theory's domain. As the number of boundary-determining criteria increases, the theory's units and laws of interaction become more homogeneous. Conversely, as the number of boundary-determining criteria decreases, theory's units and laws of interaction become more heterogeneous.

Researcher-theorists have two approaches to identifying a theory's boundary-determining criteria. The first is through logic. The second is through empirical research. According to (Dubin, 1978):

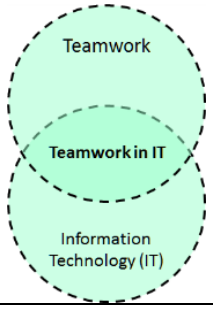
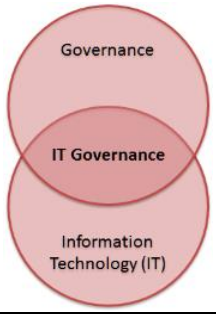
> *"In model building a scientist has two courses open to him with respect to boundary-determining criteria. (1) He may use a logical test, like the syllogism, to be certain that the units employed and the laws by which they interact all satisfy the same boundary determining criterion and therefore may be incorporated into the same model. (2) The alternative course open in model building is to employ an empirical test to determine whether a supposed sharing of boundary-determining criterion is, in fact, a reality."* (Dubin, 1978, p. 128).

According to Dubin, in fact over the open boundary there is exchange between the domains through which the boundary extends, whereas over the closed boundary, exchange does not take place (Dubin, 1978, p. 126).

The application of internal and external boundary-determining criteria is related to the theory-building strategy employed by the researcher-theorist in developing the theory. Lynham (2000) points out that logic can be the basis for specifying boundary-determining criteria. Thus, this study uses logic tests to clarify the theory's boundary-determining criteria.

We can infer as *theory open boundary characteristics*, the whole social, economic, cultural, technological and political environment in which the organizational context resides. While, the *theory close boundary characteristics* are described by the social, economic, cultural, technological and political inner environment belonging to the organizational context.

Table 4.9 – Theory boundaries: summary of classification. Source: Own elaboration.

ID	Boundary type	Boundary	Dubin's homogeneity criteria
B1	The open boundary	**Organizational contexts**: only those units and laws of interaction that relate to the organizational contexts of the Agile Governance in *IT teamwork* perspective are within the domain of this theory, insofar it is: team, project, business unit, enterprise, or a multi-organizational setting.	• Teamwork • Information Technology (IT) 
B2	The closed boundary	**IT Governance domain**: only those organizational approaches that can be classified as *IT Governance*, fall within the domain of this theory.	• Governance • Information Technology (IT) 

There are two general categories of criteria that can bound a theory. Interior criteria are those specified based on the units and laws internal to the theory (Dubin, 1978). Exterior criteria are those imposed from outside the theory (Dubin, 1978). **Table 4.9** depicts the summary of classification for the boundaries of the theory. Details will be discussed in the following Sections. Internal criteria and external criteria are described in turn. Within each subsection, the relevant boundary-determining criteria for the "Agile Governance Theory" are presented.

4.3.3.1 Internal Boundary-Determining Criteria

Internal boundary criteria are "*derived from characteristics of the units and laws employed in the model*" (Dubin, 1978, p. 128). Three general procedures exist for determining a theory's boundaries. The *first* of these is the use of *truth tables* to determine the logically validity of propositional expressions, such as a law of interaction. The *second* general procedure is to specify a *limit of probability* on the values of the units used in the theory. Finally, the *third* general procedure is *sub setting the property space*. *Sub setting the property space* uses an affirmative criterion to distinguish a unit or law of interaction from other possible types. Together, these procedures provide a set of tools that researchers can choose from to help identify internal boundary criteria. This study employed the procedure ***sub setting the property space*** to determine the theory's only internal boundary criteria.

Dubin states: "*A subsetting operation for determining a model boundary may be best understood by remembering that it takes a positive set of criteria to determine the characteristics of a category and that all other or residual categories may simply be designated by the term not _____. Thus, if we can define category A, then all other categories may be defined as not-A*" (1978, p. 131).

In this study, the phenomenon under investigation is agile governance. As stated in Section 3.7.6, those phenomena were identified in its related fields of study (the listed four major groups: Software Engineering, Enterprise, Manufacturing and Multidisciplinary) and characterized in 16 specific forms of expression (the categories where they take place).

Table 4.10 – Internal Boundary Criteria: sub setting the property space. Source: Own elaboration.

ID	Category	Characteristics	Description	Boundary-determining criteria
B1	Organizational context	The internal environment to the organizational context is the social, economic, cultural, technological and political environment belonging to it; insofar it can be, in increasing order of complexity: team, project, business unit, enterprise, or a multi-organizational setting.	The organizational context is the influence of social positions and roles on individuals of a group, and refers to the scope of an institution (Bhattacharya et al., 2014; Chandrasekaran et al., 2015; Ngo et al., 2012; Porter and McLaughlin, 2006; Pugh et al., 1969), such as: ▪ Multi organizational settings (complex environments where multiple organizations are related through alliances, partnerships or competition); ▪ Parent organization (organization owning one or more entities); ▪ Enterprise (an entire organization); ▪ Business unit, division, department or sector (a sub-organization within the overall organization); ▪ Project (a temporary organization) (PMI, 2013); ▪ Team (a group of people with a full set of complementary skills that collaborate to reach common objectives).	▪ People working in teams and their various combinations ▪ In the context of Information Technology (IT)
Not-B1	Not organizational context	-	-	-

In addition, we are interested in *people working in teams* in its various combinations (teamwork) belonging to the organizational contexts of *Information Technology (IT)*, as depicted by respective figure in **Table 4.9**.

Thus, in the context of *sub setting*, organizational change approaches that embody these positive criteria fall into the category organizational context, category (OC). Other approaches to organizational change that do not meet the positive criteria do not fall into the category organizational context and instead fall into the category (not-OC). The detailed classification of the internal boundary-determining criteria is depicted in **Table 4.9.**

4.3.3.2 External Boundary-Determining Criteria

External boundary conditions are imposed from outside of the theory (Dubin, 1978). Most frequently, external boundary criteria are employed in a theory when a new unit or a new law of interaction or both is required to augment the theory.

In particular, Dubin (1978) indicates that when a new intervening variable is identified in the literature it often signals that a new boundary-determining criterion has been established for an older scientific model.

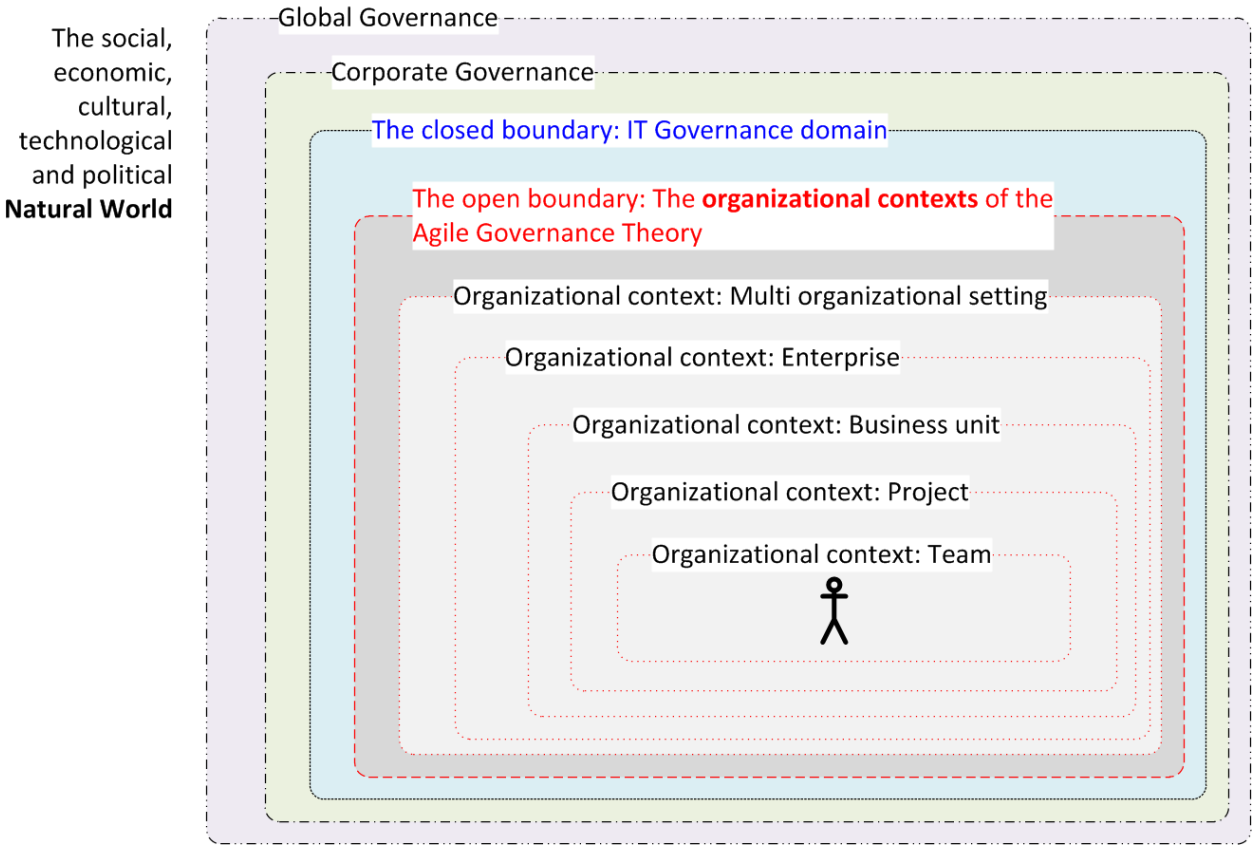


Figure 4.9– Boundary criteria: Agile Governance Theory. Source: Own elaboration.

Maintaining the coherence with the nature of the field of study widely discoursed in Section 3.4 we are concentrated in exploring the operation of the theory in *Governance* in the context of *Information Technology (IT)*, as depicted by respective figure in **Table 4.9**.

The following, we defined the theory's internal and external boundaries, namely:

- Only those organizational approaches that can be classified as ***IT Governance*** fall within the domain of this theory; and
- Only those units and laws of interaction that relate to the organizational contexts of the ***Agile Governance perspective for teamwork in Information Technology (IT)*** are within the domain of this theory.

Figure 4.9 provides an illustration of the boundaries of the theory.

4.3.4 STEP 4: Defining System States of the Theory

This Section presents the system states of the theory. These system states represent conditions of the theoretical model in which the units of the theory interact differently. The output of this Section addresses the question, "*What are the system states of theory?*". In answering this theory-development question, the researcher-theorist completes step four, the final step, in the conceptual development phase of Dubin's theory building research methodology. The Section depicts the system states for the theory.

In order to identify a theory's system states, the theory must first be considered as a system (Lynham and Chermack, 2006). This means that the theory must be perceived as a bounded set of units, interrelated by laws of interaction, from which deductions are possible about the behavior of the overall system (Lynham, 2000).

Systems may exist in different states. A system state is a condition of the theoretical model in which the units of the system interact differently. During these different system states each of the system units takes on a characteristic value for some time interval (Dubin, 1978).

Indeed, Dubin states that "*the essential notion of a system state is that the system as a whole has distinctive features when it is in a state of the system. The manner, however, in which we are able to designate a system state is through the recognition of the characteristic values of the units when the system is in that particular state. Thus a system state is apprehended only by*

knowing the characteristic values of all the units of the system. These values, in turn, must be determinant. If any of the values of any units are indeterminate, then an analytical problem arises as to whether the system as a whole is in a system state or whether the system is in transition between system states." (1978, p. 144).

Dubin (1978) further identified three criteria of importance to the researcher-theorist when identifying the system states of the theory, namely, (i) *inclusiveness*, (ii) *persistence*, and (iii) *distinctiveness*. **Table 4.11** depicts these criteria.

Table 4.11 – Criteria of importance. Source: Adapted from (Dubin, 1978; Torraco, 2000).

Criteria of importance	Description	Considerations
Inclusiveness	The criterion of inclusiveness refers to the need for all the units of the system to be included in the system state of the theory (Dubin, 1978; Torraco, 2000).	The inclusiveness criterion states that all of the units within the system have a distinct value, or range of values, when the theoretical model is in that system state.
Persistence	The criterion of persistence requires that the system state persist through a meaningful period of time (Dubin, 1978; Torraco, 2000).	System state must persist through "some" period of time. But, how much is "some"?! For instance, if in natural science (e.g. Physics, Chemistry, etc.) this period might be a fraction of a second. On the other hand in social sciences (e.g. Economy, Politics, etc.) that period can last years or decades.
Distinctiveness	And the criterion of distinctiveness requires that all units take on determinant, that is, measurable and distinctive, values for the system state (Dubin, 1978; Torraco, 2000).	The determinate values criterion states that the values of all the units in the model may be measured, at least in principle, by instruments that give true values.

Among several examples, Dubin still give us an easy illustration to exemplify the meaning of system states when he highlights this concept in a theoretical model of traffic flows, including when he mentions the recurrence of system states. In this instance the systems states "rush hour" and "non-rush hour," may be beneficial in predicting "*how long it will take to get to work*" (Dubin, 1978, p.150).

Genuinely, in explaining system states it is useful to distinguish them from outcomes of a theoretical model. An outcome of a model is defined as the value of a single unit or the values of a single region of units within a model that gives to that unit or region a distinctive analytical character (Dubin, 1978). In contrast, *system states* refer to the state of the system as a whole. A *system state* is defined by the unique combination of values for all units comprising the system. This configuration of values defines the entire system as a unique condition. *Outcomes*, on the other hand, are conditions of one or more units of a theoretical model but not of all of them simultaneously (Dubin, 1978).

Dubin, however, clarify that not all theoretical models specify system states. The notion of system states may be ignored if the three system-state criteria are not met or if only one system state exists. Where appropriate, however, the specification of system states of a theoretical model may increase the model's predictive capability (Dubin, 1978).

Two different *classes of system states* were identified in this theory building process: (1) **Macro-system states**: the system states related to the stage of awareness in agile governance; and, (2) **System states**: the system states related to the theory operation. **Table 4.12** depicts the summary of classification for the *macro-system states* of the theory, while **Table 4.13** does the same to the *system states*. Details will be discussed in the following Sections.

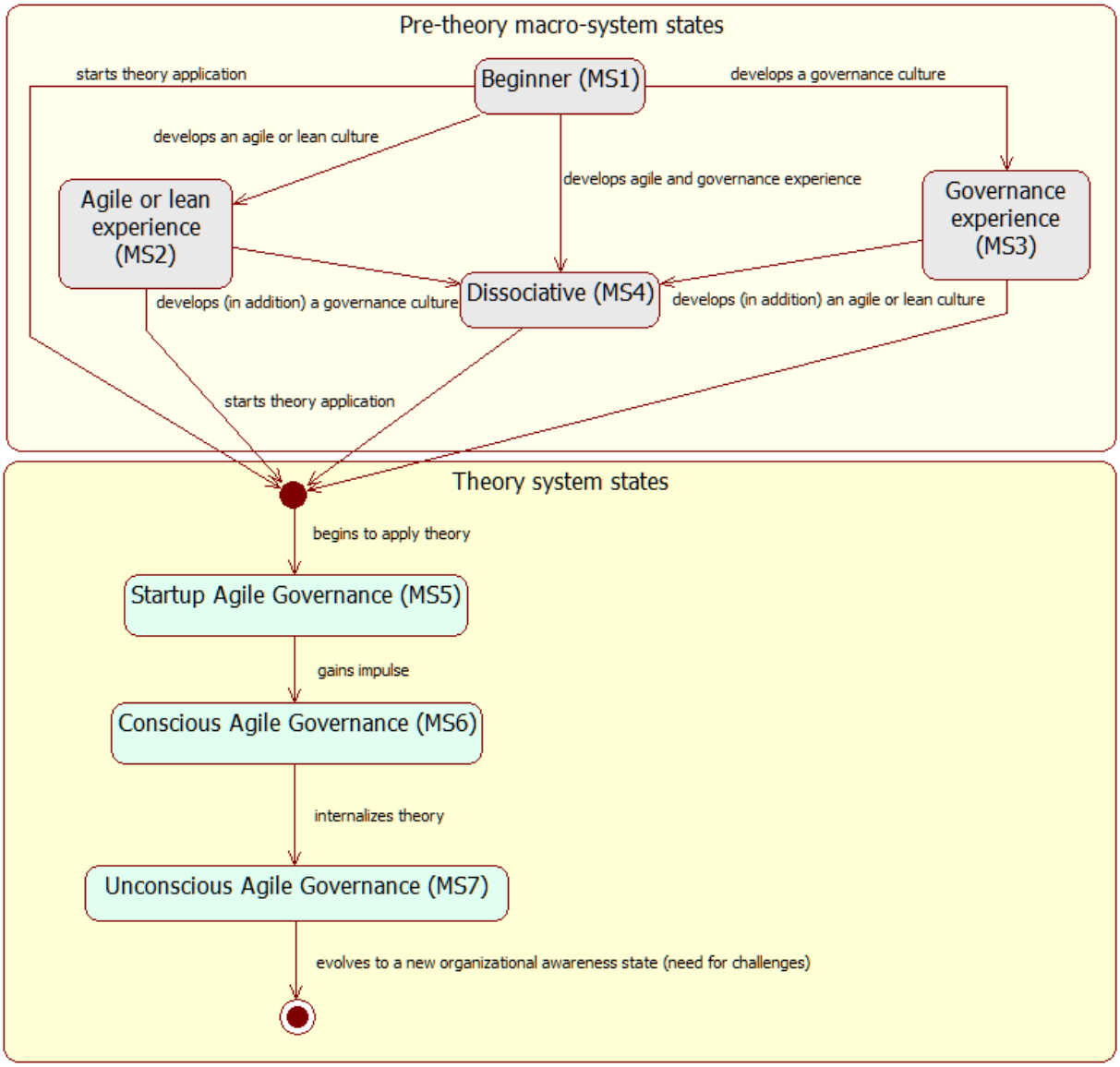


Figure 4.10– Theory of Agile Governance: Macro-system states. Source: Own elaboration.

4.3.4.1 Macro-system states

During the data analysis, by means of the triangulation of the sources of theoretical sampling chosen to this research and described in Section 2.2, we have identified two kinds of macro-system states:

(1) **Pre-theory macro-states**: related to the awareness found in the organizational context in the real world, before the theory application, whereas at least two of them were evidenced and discussed in APPENDIX II.6 and 3.7.10 [also published in (Luna et al., 2014b)], when we have highlighted overall trend movements in agile governance phenomena: **Trend 1** (agile or lean experience); and, **Trend 2** (governance experience), both depicted in **Figure 3.11.**

(2) **Theory system states**: related to the level of awareness in agile governance developed by means of the application of the theory.

Figure 4.10 depicts these macro-system states, while **Table 4.12** details their description, conscious level, characteristics values and other information.

Table 4.12 – MACRO-system states: summary of classification. Source: Own elaboration.

Type	ID	Macro-system state	Consciousness level	Description	Characteristic Values
Pre-Theory	MS1	Beginner (Need to start)	Unconsciously incompetent	In this system state fits organizational contexts in which there is no governance experience, neither an agile culture established. This state is characterized by maximum values of [E] and [M], null values of [A] and [G], serendipitous values for [B], and minimum rate for [R] (likely very close to zero).	• E=maximum[49] value • M=maximum value • A=zero • G=zero • B= serendipitous • R=minimum rate (likely very close to zero)
Pre-Theory	MS2	Agile or lean experience (Need for control)	Consciously incompetent	In this system state fits organizational contexts in which there is already an agile culture, however focused on specific agile approaches. They probably feel the need to implement governance practices. Occasionally, they wish to develop efforts to bring these practices to their core business. This state is characterized by high values of [E] and [M], null values for [G], and increasing values for [A] and [B] (likely low), as well as serendipitous values for [R] (likely low).	• E=high value • M=high value • A=increasing in a localized manner • G=zero • B=increasing (likely low) • R=serendipitous rate (likely low)
Pre-Theory	MS3	Governance experience (Need for speed)	Consciously incompetent	In this system state fits organizational contexts in which there is already any governance experience. In some case, they perceive that the conventional practices can	• E=high value • M=high value • A=zero • G=increasing (likely low)

[49] When we mention minimum or maximum values to the theory units, we wish only give an idea of potential for their low and high effects in the system described by this theory. Indeed, these values depend on the particularities of each organizational context, and cannot be estimated without an empirical study where the context is a determinant influential variable. This kind of study is a nice topic for future works.

Type	ID	Macro-system state	Consciousness level	Description	Characteristic Values
				be heavy and/or bureaucratic. Once in a while, they wish to develop efforts to become governance quick and easy in order to achieve better results in their core business. This state is characterized by high values of [E] and [M], null values for [A], increasing values for [G] and [B] (likely low), as well as serendipitous values for [R] (likely low).	• B=increasing (likely low) • R=serendipitous rate (likely low)
Pre-Theory	MS4	Dissociative (Need for compass)	Unconsciously incompetent	In this system state fits organizational contexts in which there are already any specific agile approach and/or any governance experience (they may even have performed or be performing it), but they are not applying agile capabilities [A] and governance capabilities [G], in a combined and coordinated manner, to achieve better results in their core business. This state is characterized by high values of [E] and [M], as well as probably serendipitous values for [A], [G], [B], and [R] (likely low).	• E=high value • M=high value • A=serendipitous • G=serendipitous • B=serendipitous • R=serendipitous (likely low)
Theory	MS5	Startup Agile Governance (Need for impulse)	Consciously incompetent	In this system state fits organizational contexts in which has already started the application of the theory. This state is characterized by high (but decreasing) values of [E] and [M], as well as increasing values for [A], [G], [B] and [R] (likely low).	• E=decreasing value (likely high) • M= decreasing value (likely high) • A=increasing value (likely low) • G=increasing value (likely low) • B=increasing value (likely low) • R=increasing value (likely low)
Theory	MS6	Conscious Agile Governance (Need for internalization)	Consciously competent	In this system state fits organizational contexts in which have already reached a primary level of organizational sustainability and competitiveness by application of the theory. This state is characterized by low (and decreasing) values of [E] and [M], as well as increasing values for [A], [G], [B] and [R] (likely high).	• E=decreasing value (likely low) • M=decreasing value (likely low) • A=increasing value (likely high) • G= increasing value (likely high) • B= increasing value (likely high) • R= increasing value (likely high)
Theory	MS7	Unconscious Agile Governance (Need for challenge)	Unconsciously competent	In this system state fits organizational contexts in which have already reached a high level of organizational sustainability and competitiveness. They have already develop their activities in a high level of awareness (achieved by people and entire organizational context that have assimilated deeply the agile governance theory), acting and reacting in an unconsciously competent manner, almost intuitively, to deal with the emerging issues from the organizational context, as well as within the environment where they are inserted. This state is characterized by minimum values of [E] and [M] (likely very close to zero), maximum values for [A], [G], [B] and [R].	• E=minimum value • M=minimum value • A=maximum value • G=maximum value • B=maximum value • R=maximum value

These macro-system states will originate the theoretical scenarios that will be discussed at Section 4.5.3.

4.3.4.2 System states

Throughout this step of theory building method we identified five micro-system states *(or plainly system states)*, as depicted in **Figure 4.11** and detailed in **Table 4.13**. All of them are related to the operation of theory.

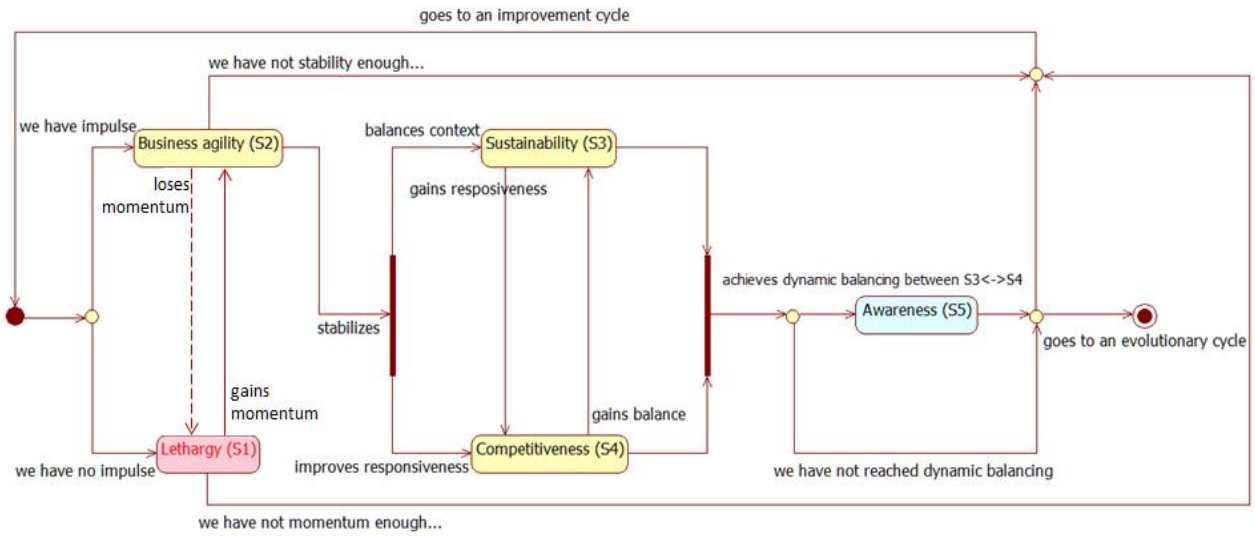


Figure 4.11 – Theory of Agile Governance: system states. Source: Own elaboration.

These respective system states are activated by the progression of the values of the theory units, as detailed in **Table 4.13**.

Table 4.13 – Theory System states: summary of classification. Source: Own elaboration.

ID	System state	Description	Characteristic Values
S1	Lethargy	A lethargic state can compromise the entire organizational context, when fatigue, weariness (caused by exertion), or even by bad results or high level of stress caused by business pressure, befall upon the morale of the team. These circumstances entail on the following consequences: very high (and increasing) values for [E] and [M] causing serendipitous (and likely very low) values for [A], [G], [B] and [R], which in turn generate their progressive decreasing.	• E=increasing (likely very high) • M=increasing (likely very high) • A=decreasing (likely very low) • G=decreasing (likely very low) • B=decreasing (likely very low) • R=decreasing (likely very low)
S2	Business agility	Business agility arises when the organizational context: (1) combines coordinately agile capabilities [A] and governance capabilities [G], applying subsequently their resultant effect upon business operations [B] (as described by 1st Law); or even, when, (2) agile capabilities [A] are applied directly on business operations [B] (as characterized by 2nd Law). The first approach entails the increasing of [A], [G] and [B], which	• E=decreasing (likely intermediate) • M=decreasing (likely intermediate) • A=increasing (likely high) • G=increasing or unchanged* (likely high) • B=increasing (likely intermediate) • R=increasing (likely

ID	System state	Description	Characteristic Values
		in turn increases [R]; whereas the second approach keeps unchanged [G]*, but leads to the increasing of [A] and [B], which in turn enhances [R]. The effect of the former approach is *broader* and *systematic*, whereas the effect of the later approach is *localized* and *narrow*. Despite the 1st Law generates faster results than 2nd Law, in both cases, respecting the proper proportions for each approach: [M] and [E] start to gradually decrease over the time, contributing to decrease the inhibition, restriction or disturbing on organizational context.	intermediate)
S3	Sustainability	Organizational sustainability arises when [A] and [G] reach high values in the organizational context and their combined and coordinated application on [M], contributes to diminishing the inhibition and restriction [M] of the organizational context, even without changing significantly [E]. As a result, the gradual decreasing of [M] values accelerates the increase of [B], which in turn enhances [R].	• E=decreasing (likely intermediate) • M=decreasing (likely low) • A=increasing (likely high) • G=increasing (likely high) • B=increasing (likely high) • R=increasing (likely high)
S4	Competitiveness	Organizational competitiveness emerges when [A] and [G] achieve high values in the organizational context and their combined and coordinated application on [E], contributes to decreasing the disturbances effects [E] felt by the organizational context, whereas causes a slight decreasing on [M]. As a consequence, the gradual reduction of [E] and [M] values speeds up the raising of [B], which in turn increases [R].	• E=decreasing (likely low) • M=decreasing (likely intermediate) • A=increasing (likely high) • G=increasing (likely high) • B=increasing (likely high) • R=increasing (likely high)
S5	Organizational awareness (or vitality)	Organizational awareness (or vitality) arises when the organizational context attains a responsive balancing by means of *sustainability* [S3] and *competitiveness* [S4][50] (i.e., a positive *dynamic balancing*[51] between these system states), resulting in a superior performance, where: (i) decreases to very low levels the influence of [E] and [M]; and, (ii) increases to very high grade the values for [A], [G], [B] and [R], which in turn cause their progressive and continuous increasing.	• E=decreasing (likely very low) • M=decreasing (likely very low) • A=increasing (likely very high) • G=increasing (likely very high) • B=increasing (likely very high) • R=increasing (likely very high)

In alignment with Dubin's *inclusiveness* criterion, each of the units in the theoretical model (representing the emerging theory) is included and has a *distinctive* value in every system states. The emerged system states, also meets Dubin's additional criteria, namely: *determinate values* and *persistence*. In accordance with the determinate criterion, each of units within the theoretical model can be measured, at least in principle, during every system states. In accordance with the persistence criterion:

[50] In this case, we are not citing references from our Systematic Literature Review, detailed in APPENDIX I.2. In fact, we are mentioning the theory system states numbers 3 and 4 from **Table 4.13**, respectively.

[51] Referring to the adaptability of some "system states" with which a given "constructs' setting" may have a *stimulating effect* on the "organizational context" in one instance (*awareness* system state), and a soothing effect in another instance (*lethargy* system state).

i. The ***pre-theory macro-system states*** persist as long as the "time period" that the organizational context takes to adopt the theory or even, that an *unexpected event*[52] can take it to change to a different (pre-theory) macro-state.

ii. In turn, the ***theory macro-system states*** persist as long as the *agile governance evolutionary cycle* (as depicted in **Figure 4.11**, and detailed in **Figure 4.10**), taking into account how many *improvement cycles* that the organizational context need to achieve a new macro-system state.

iii. Finally, the ***system states*** would persist as long as the agile governance *improvement cycle* occurs, as depicted in **Figure 4.11**.

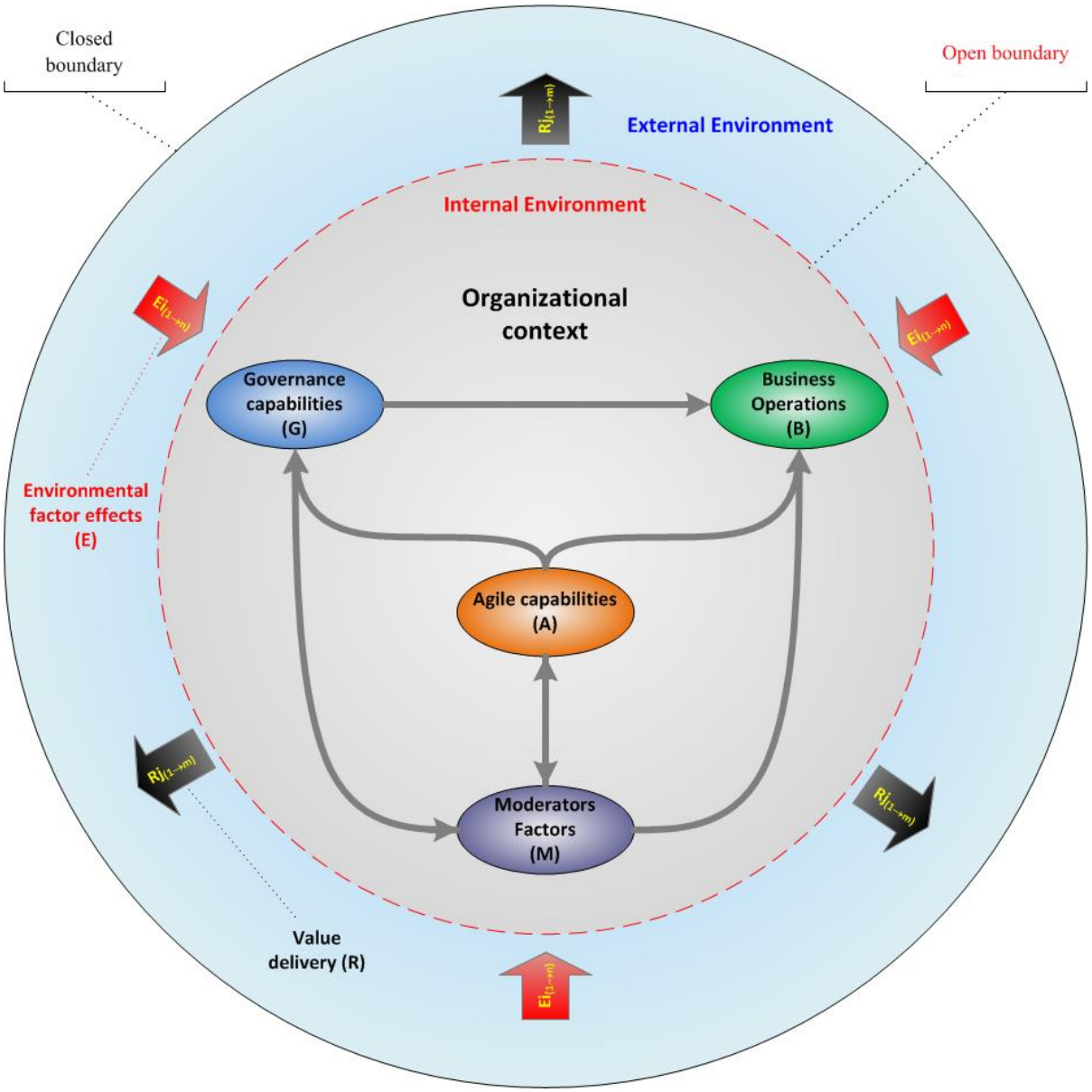


Figure 4.12 – The Conceptual Model of "*Agile Governance Theory*" (clown face diagram). Source: own elaboration.

[52] Any *unknown event* at the time of building of this theory, which the explanation or prediction is outside the scope of this theory.

4.3.5 Conclusion to part one: the Conceptual Development phase of the theory

The outcome of the **conceptual development phase** of the theory-building research process is a fully conceptualized theoretical model that represents the emerging theory (Dubin, 1978; Lynham, 2002a, 2002b; Tuttle, 2003). The components of the model are: the theory's *units*, its *laws of interaction*, its *boundary-determining conditions*, and its *system states*. Each of these components has been completed here. The study has therefore addressed the question: *Can an agile governance theory be conceptualized?* This question is answered affirmatively. After complete the fourth step of the Dubin method we are able to represent graphically the conceptual framework of theory, as depicted in **Figure 4.12**.

The constructs *Effects of environmental factors* $[\boldsymbol{E_{i_{(1\rightarrow n)}}}]$[53] and *Value delivery* $[\boldsymbol{R_{j_{(1\rightarrow m)}}}]$[54] are border phenomena and they are represented by means of red and black arrows, respectively. The gray arrows connecting constructs describe the interaction between each one of them, stated by the *laws of interaction* (see Section 4.3.2).

4.4 THEORY BUILDING PART TWO – Research operation

This Section addresses part two, research operation. Part two entails developing the theory's *propositions*, *empirical indicators*, *hypotheses*, and *research agenda* to begin testing the theory. Completion of part two allows the research to answer study's second research question, "*Can an agile governance theory be operationalized?".*

This Section proceeds through steps five through seven of Dubin's theory-building methodology. The following Section begins with **step five**, the specification of *propositions* for the theory. Next, we complete **step six**, the identification of *empirical indicators* for key terms. In turn, we then complete **step seven**, the development of the theory's *hypotheses*. Finally, the subsequent Section lays out a proposed *research agenda* that will be employed to test the theory (in Chapter 5), **step eight**.

[53] The notation describes the fact that each factor from the external environment receives an index "*i*", which varies from 1 to "*n*", where "*n*" is the total number of "environmental factors' effects" [E] that operates in a particular instance of the theory.

[54] The notation describes the fact that each outcome from the organizational context has its "value delivery" [R] component, and receives an index "*j*", which varies from 1 to "*m*", where "*m*" is the total number of outcomes from organizational context, in a particular instance of the theory.

4.4.1 STEP 5: Developing Propositions

An important objective of any theoretical model is to generate predictions about the empirical domain it represents (Dubin, 1978). Conforming to Dubin, this is where the real fun begins: "*Quite simply, the use of the model is to generate predictions or to make truth statements about the model in operation. Indeed, it is at this point that theory building becomes exciting and thoroughly interesting. The design of the model is, of course, an exacting task. However, to put the model to work, to see what it can do in operation, is the feature of theorizing that makes the game more than worth the effort* (p. 163).

Any predication arising from a scientific model takes the form of propositional statements about the values of the model's units (Dubin, 1978). Dubin (1978) points out that the propositional statements represent predictions because they alert us to what must be true about the model in operation given its component *units*, *laws of interaction*, *boundaries*, and *system states*. A proposition of a theoretical model is, then, a truth statement about the model in operation (Dubin, 1978). Propositions may be either positive or negative truth statements. In either case, they are always truth statements about the values taken by the system's units (Dubin, 1978). Propositions are derived from the logic underlying a theoretical model. Thus, the 'truth' of a proposition is based on whether the proposition flows logically from the model to which it applies, not the degree to which it is validated empirically. Assessment and refinement of theoretical model is left to **step eight**, testing (Dubin, 1978).

Table 4.14 – Basic distinctions between propositions and different types of truth statement. Source: Adapted from (Dubin, 1978).

Truth statement	Distinction
About the set membership of units	According to Dubin (1978), "*propositions are not about the location of the system components in their respective sets*," (p. 163). For instance, the assignment of a unit (e.g. Plato) to a specific set (e.g. man) does not predict the unit's value and is therefore not a proposition.
About Laws of interactions	Laws of interaction specify the relationship between two or more units of a theoretical model for all values over which the units are linked by the law (Dubin, 1978). In contrast, propositions make explicit the value of one unit that is related to a corresponding value of another unit (Dubin, 1978). Dubin writes, "*the law of interaction tells what the relationship is, and the proposition states what the predicted values will be*" (1978, p. 170).

In addition, as stated by Dubin, "*the only criterion of consistency that propositions of a model need to meet is the criterion that their truth be established by reference to only one system of logic for all the propositions set forth about the model*" (1978, p. 160).

As depicted in **Table 4.14**, Dubin (1978) was careful to point out two *distinctions between propositions* and two different *types of truth statement*, in defining propositions. In complement, Dubin (1978) identifies three general *classes of propositions*, where all propositions fall into one of these three classes; exhausting (these classes) all logical possibilities. These classes are depicted in **Table 4.15**.

Table 4.15 – General classes of propositions. Source: Adapted from (Dubin, 1978, p. 165-166).

Classes of propositions	Description
Type I: From values of a single unit	Propositions may be made about the values of a single unit in the model, the values of that unit being revealed in relation to the value of other units connected to that unit in question by a law of interaction.
Type II: From continuity of a system state	Propositions may be predictions about the continuity of a system state that in turn involves predictions about the conjoined values of all units in the system.
Type III: From oscillation between system states	Propositions may be predictions about the oscillation of the system from one state to another that again involves predictions about the values of all units of the system as they pass over the boundary of one system state into another.

Further to the specification of the propositions of the theory, Dubin (1978) indicated that in specifying propositions for a theory, there are three criteria for consideration by the researcher-theorist, namely, *consistency*, *accuracy*, and *parsimony*.

Table 4.16 – Propositions: criteria for specification. Source: Adapted from (Dubin, 1978; Lynham, 2002a).

Criterion	Description
Consistency	The criterion of consistency in specifying the propositions of a theory refers to the notion that the truth of the propositions "*be established by reference to only one system of logic for all the propositions set forth in the [theoretical framework]*" (Lynham, 2002a, p. 160). A system has specific characteristics, *namely*, a *name*, a *purpose*, *parts*, *interactions among the parts*, and *outcomes* or *outputs*. To meet this criterion each of the propositions of this theory is associated with one or more of these system characteristics to ensure consistency in the propositions specified for the theory.
Accuracy	The criterion of accuracy refers to whether the propositions follow logically from the theoretical framework to which they apply. Each of the propositions specified for the example theory is informed by and follows from the specified system of *units*, *laws of interaction*, *boundaries*, and *system states* that make up the theoretical framework of the theory. The logic of these components of the theoretical framework is maintained in the logic of the specified *propositions* of the theory (Dubin, 1978).
Parsimony	The criterion of parsimony, when considered in relation to the specification of the propositions of a theory, refers to the use of what Dubin (1978) called "*strategic propositions*" (p. 166). Dubin pointed out that "*in principle, every [theoretical framework] should give rise to an infinite number of propositions*" (p. 166). However, it is not the job, in the specification of the propositions of a theory, to identify all possible propositions for that theory. It is, according to Dubin, more important to seek some parsimony in the specification of propositions.

Within these classes an infinite number of propositions may arise from any given theoretical model. Dubin writes, "*The number of propositions is the sum of different ways the values of all the units in the model may be combined with the values of all other units with which they are lawfully related*" (1978, p. 166). As a result, to meet the parsimony criterion, a deliberate way is

needed to weed out trivial propositions (Dubin, 1978). This need leads immediately to the concept of *strategic propositions*.

Table 4.17 – Theory's propositions: summary of classification. Source: Own elaboration.

ID	Proposition	Proposition statement	Type	Traceability
P1	**Lifecycle**	**During the theory application, the [values of the] agile capabilities [A] and governance capabilities [G] will increase.**	**Type I Strategic**	**L1, L2, S2, S3, S4, S5**
P2	**Business agility**	**If the agile capabilities [A] and governance capabilities [G] are high, then the business operations [B] [performance] will increase.**	**Type I Strategic**	**L1, L2, L5**
P3	**Value delivery**	**If the business operations [B] [performance] increase, then value delivery [R] will increase.**	**Type I Strategic**	**L6**
P4	**Countermeasures**	**If the agile capabilities [A] and governance capabilities [G] are high, then effects of environmental factors [E] and effects of moderator factors [M] will decrease.**	**Type I Strategic**	**L3, L4, L5**
P5	**Less effects**	**If the effects of environmental factors [E] and effects of moderator factors [M] are low, then the business operations [B] [performance] will increase.**	**Type I Strategic**	**L3, L4, L5**
P6	Lethargy	If the effects of environmental factors [E] and effects of moderator factors [M] are high, then the business operations [B] [performance] will decrease, which can lead the whole system to a state of "*lethargy*" [S1].	Type II Non-strategic	L3, L4, S1, S3
P7	Sustainability & Competitiveness	The system state "*business agility*" [S2], will precede the system state [organizational] "*sustainability*" [S3] and "*competitiveness*" [S4].	Type III Non-Strategic	S2, S3, S4
P8	Awareness or vitality	If a balance between [organizational] "*sustainability*" [S3] and "*competitiveness*" [S4] is attained and maintained persistently (for a time period enough to its institutional internalization), then the organizational context goes into a state of [organizational] "*awareness*" [S5], achieving whole system its maximum performance.	Type III Non-Strategic	S3, S4, S5
P9	Pre-theory states	All *pre-theory macro-system states* will precede the *theory macro-system states*.	Type III Non-Strategic	MS1, MS2, MS3, MS4, MS5, MS6, MS7
P10	Internalizing	The macro-system state "*Startup*" [MS5] will precede the macro-system state "*Conscious Agile Governance*" [MS6].	Type III Non-Strategic	MS5, MS6
P11	Quantum	The macro-system state "*Conscious Agile Governance*" [MS6] will precede the macro-system state "*Unconscious Agile Governance*" [MS7].	Type III Non-Strategic	MS6, MS7

Strategic propositions are distinguished from trivial proposition by their significance. Strategic propositions are those that, once tested, will corroborate or identify the need to modify a theoretical model. Strategic propositions are typically those that "*state critical or limiting values for the units involved*" (Dubin, 1978), p. 168). Critical or limiting values are those at which a unit reaches a minimum or maximum point, a zero value for associative units, or the values for one unit at which related units are predicted to increase or decrease in value (Dubin, 1978). In keeping with Dubin (1978), in deciding upon propositions of a model for empirical testing, it is preferable in the interest of *parsimony* to choose *strategic propositions* over *trivial*

propositions. Typically, proposition statements take the form of "*If... then*" (Dubin, 1978, p. 164).

Table 4.17 depicts the **eleven** propositions specified for this theoretical model using Dubin's three classes of propositions as a framework. **Five of them were considered *strategic* to test the plausibility of the model [P1..P5]**.

4.4.2 STEP 6: Identifying Empirical Indicators

This Section specifies *empirical indicators* for the theory. These *empirical indicators* identify operations that allow the researcher-theorist to measure the values of the units in the theoretical model. Thus, the output of this Section addresses the question, "*Which are the empirical indicators of the theory?*"

As stated by (Dubin, 1978) the development of empirical indicators allows the model's *propositions* or predictions *to be tested for empirical accuracy*. This requires that the researcher-theorist put aside the internal workings of the theoretical model and turn his or her attention externally.

The first step in establishing the empirical accuracy of the model's propositions is to identify an empirical indicator for each of the units employed in every proposition to be tested (Dubin, 1978). An empirical indicator is an operation used by a researcher to determine measurements of values on a unit (Dubin, 1978).

Table 4.18 – Principle criteria to the adequacy of an empirical indicator. Source: Adapted from (Dubin, 1978).

Criterion	Description
Observer and apparatus	The operation involved in the relation between observer and the apparatus used for observing are explicitly set so that they may be duplicated by any other equally trained observer.
Observing operation	The observing operation produces equivalent values for the same sample when employed by different observers," (Dubin, 1978, p. 183).

Identification of empirical indicators therefore involves a process of measurement of the unit concerned. This process of measurement contains two principle *criteria to determine the adequacy* of an empirical indicator. These criteria are depicted in **Table 4.18**.

Empirical indicators must therefore satisfy the two principal criteria of what Dubin called "*operationism*"[55] (p. 183) and "*reliability*"[56] (p. 185). Further to these two parts to empirical indicators, (Dubin, 1978) also identified two classes of empirical indicators, as depicted in **Table 4.19**.

Table 4.19 – Classes of empirical indicators: criteria for specification. Source: Adapted from (Dubin, 1978).

Class	Description
Absolute indicators	Refer to indicators that "*have no question as to what they measure*" (p. 193). An example of an absolute empirical indicator in the social sciences would be race, sex, or age.
Relative indicators	"*The primary characteristic of a relative indicator is that it may be employed as an empirical indicator of several different theoretical units*" (p. 195). An example offered by Dubin of a relative empirical indicator is income, which can be employed as a measure of both economic position and social class position.

Dubin cautions that the researcher-theorist must ensure that the *empirical indicators* chosen are appropriate for the class of unit, because the types of units used in a theory affect the empirical indicators to be identified. For instance, *associative* units are defined as a property characteristic of a unit in only some of its conditions (Dubin, 1978). Associative units can therefore have a zero value. Thus, empirical indicators for associative units, as is the case of every unit of this theory, must be *capable of producing zero values* and, where appropriate, *negative values* (Dubin, 1978). Empirical indicators normally take the standard form of "*The value of unit X as measured by...*" (Dubin, 1978, p. 185).

Five strategic propositions regarding the theoretical model were developed in the previous Section. In order for these propositions to be tested, empirical indicators for the units in each proposition must be identified. Each of these empirical indicators must meet Dubin's criteria of *operationism* and *reliability* and must be consistent with the unit's classification. Many valid empirical indicators may exist for each unit. Under these circumstances (Flor and Oltra, 2004; Hollenstein, 1996; Saviotti and Metcalfe, 1984; Taylor, 2004; Yam et al., 2004; Zheng et al., 2009) leaves the choice up to pragmatic considerations. **Table 4.20** presents the empirical indicators for each unit in the theoretical model.

In order to support the choice of indicators for each construct, the column "**References**" of the **Table 4.20** describes the source of *evidences* that directly or indirectly suggest use of these empirical indicators. Likewise, the development of *nomological networks* for each theory unit,

[55] It seeks to demonstrate that the empirical indicator of a unit is an operation performed by an observer with some kind of observing instrument (Dubin, 1978, p. 184).

[56] It aims to verify that an empirical indicator produces reliable values, either by means of *observer reliability*, as by *instrument reliability* (Dubin, 1978, p. 185).

during the analysis of construct validity in Section 4.3.1, was very useful to confirm the choice of these *empirical indicators*, as well as it will be quite determinant to the subsequent empirical study in favor of testing the emerging theory against the real-world (see Sections 4.4.4 and 5.2).

Table 4.20 – Theory's empirical indicators: summary of classification. Source: Own elaboration.

ID	#1[57]	#2[58]	Unit	Empirical Indicators	Metric description	Question for the survey instrument	References
E1	y1	x1	Effects of environmental factors [E]	Technological impact	[E] **as measured by** the degree of technological impact (Ordinal Scale: 1..10)	You have experienced changes (or other disturbances) on the business operations due to the occurrence of technological impact in the environment where the organizational context was inserted (e.g., technological obsolescence, changing technological paradigm, etc.).	(Andres et al., 2008; Chen et al., 2013; Conway and Nicoletti, 2006; Lambsdorff, 1999; Potrafke, 2010; Stern and Holder, 1999), [S4], [S10], [S11], [S21], [S82], [S85], [S131], [S134], [S135], [S142-S144], [S146], [S147], [S149], [S150], [S152], [S164], [NG03], [NG06], [NG07], [IT01-IT10]
E2	y2	x2	Effects of environmental factors [E]	Influence of regulatory institutions	[E] **as measured by** the degree of influence of regulatory institutions (Ordinal Scale: 1..10)	You have experienced changes (or other disturbances) on the business operations due the influence of regulatory institutions from the environment where the organizational context was inserted (e.g., government, supervisory bodies, audit, etc.).	(Andres et al., 2008; Conway and Nicoletti, 2006; Lambsdorff, 1999; Potrafke, 2010; Stern and Holder, 1999), (Caligiuri, 2013), [S1], [S3], [S4], [S6-S8], [S131], [S134], [S136], [S142], [S146], [S147], [S153], [NG03], [NG06], [NG13], [IT01-IT006], [IT08], [IT09]
E3	y3	x3	Effects of environmental factors [E]	Influence of competitiveness	[E] **as measured by** the level of competitiveness (Ordinal Scale: 1..10)	You have experienced changes (or other disturbances) on the business operations due the influence of competitors from the environment where the organizational context was inserted (e.g., due competition for budget/investment against other projects/business units/enterprises, it being affected by the launching of a competitor product/service, etc.)	(Chatwal et al., 2013; Jagodziski, 2010; Smith, 2012), [S10], [S23], [S48], [S86], [S131], [S134], [S135], [S139], [S150], [S152], [S154], [S155], [S159], [S161], [S166], [NG07], [IT01], [IT03-IT05], [IT08]
E4	y4	x4	Effects of environmental factors [E]	Economy influence	[E] **as measured by** the level of economic influence (Ordinal Scale: 1..10)	You have experienced changes (or other disturbances) on the business operations due the economic influence upon the environment where the organizational context was inserted (e.g., late payment, delay in release of funds, exchange, inflation, etc.).	(Barclay, 2010; Heskett, 2009; Kolvereid and Obloj, 1994; Morck et al., 2005; Roper et al., 2009), [S7], [S10], [S15], [S18], [S134], [S146], [NG03], [NG06], [IT01], [IT02], [IT05], [IT06-IT08]
E5	y5	x5	Effects of environmental factors [E]	Market turbulence	[E] **as measured by** the rate of change of the environment (market and its players: customers, suppliers, competitors, partners, etc.) (Ordinal Scale: 1..10)	You have experienced changes (or other disturbances) on the business operations due the turbulence of the environment where the organizational context was inserted (e.g., business requirements volatility, customer needs, globalization, etc.).	(Cameron et al., 1987; Joshi et al., 2013; Santos-Vijande and Álvarez-González, 2007; Su, 2012; Tsai and Yang, 2013), [S5], [S7], [S10], [S21], [S23], [S26], [S27], [S85], [S130], [S134], [S138], [S139], [S144], [S147], [S150], [S152], [S154], [S155], [S158], [S162], [S166], [NG01], [NG03], [NG07], [NG10], [NG11], [IT01-IT06], [IT08], [IT09]
M1	y6	y1	Effects of moderator factors [M]	Organizational culture refractoriness	[M] **as measured by** the level of refractoriness of the organizational	You have experienced restraint or inhibition (or other limiting effects) on the business operations due the influence of	(Caligiuri, 2013; Choo, 2013; Linnenluecke and Griffiths, 2010; Pulipati, 2012; Schein, 2010; Schneider et al., 2011;

[57] For theoretical scenarios where **there is no** *independent manifest variables* (φ_5 and φ_n). See Section 4.5.3.

[58] For theoretical scenarios where **there are** *independent manifest variables* (φ_0, φ_1, φ_2, φ_3, and φ_4).

ID	#1[57]	#2[58]	Unit	Empirical Indicators	Metric description	Question for the survey instrument	References
					culture (Ordinal Scale: 1..10)	organizational culture (e.g., refractory behavior, lack of team cohesion, etc.).	Smith, 2012; Sun, 2008), [S11], [S13], [S45], [S75], [S82], [S87], [S89], [S90], [S102], [S122], [S138], [S140], [S141], [S143], [S146], [S150], [S151], [S153], [S160], [NG03], [NG07-NG10], [IT01-IT05], [IT07], [IT08]
M2	y7	y2	Effects of moderator factors [M]	Leadership inadequacy	[M] **as measured by** the level of inadequacy of leadership style (Ordinal Scale: 1..10)	You have experienced restraint or inhibition (or other limiting effects) on the business operations due the influence of issues related to leadership (e.g., inadequacy of leadership style, lack of leadership, etc.).	(Antonakis and House, 2014; Bolton et al., 2013; Caligiuri, 2013; Day and Antonakis, 2013; Giltinane, 2013; Kotter, 2013; Metcalf and Benn, 2013; Schoemaker et al., 2013), [S7], [S13-S16], [S18], [S23-S25], [S29], [S30], [S45], [S49], [S51], [S55], [S60-S62], [S72-S75], [S77], [S82-85], [S87-S91], [S93], [S98], [S100-S103], [S106], [S108], [S111], [S114], [S118], [S122], [S124], [S132], [S134-S136], [S139], [S141], [S151], [S153], [S162], [S165], [IT02], [IT06]
M3	y8	y3	Effects of moderator factors [M]	Enterprise architecture inadequacy	[M] **as measured by** the inadequacy of enterprise architecture (Ordinal Scale: 1..10)	You have experienced restraint or inhibition (or other limiting effects) on the business operations due the influence of inadequacy of the enterprise architecture (e.g., organizational structure, lack of infrastructure scalability/ modularity, operation centralization/ decentralization, etc.).	(Desfray and Raymond, 2014; Lankhorst, 2009; Luisi, 2014; Rajabi et al., 2013; Simon et al., 2013), [S4], [S7-S9], [S12], [S15], [S19], [S23], [S27], [S30], [S45], [S55], [S59-S62], [S70], [S76], [S82], [S86], [S98], [S102], [S115-S116], [S123-S124], [S131], [S135], [S143], [S145-S147], [S149], [S158], [S161], [S164], [NG03], [NG11]
M4	y9	y4	Effects of moderator factors [M]	Business model inadequacy	[M] **as measured by** the level of inadequacy of business model (Ordinal Scale: 1..10)	You have experienced restraint or inhibition (or other limiting effects) on the business operations due the influence of the inadequacy of how business is structured to create, deliver, and capture value (e.g., strategic shortcoming, operational discrepancy, etc.).	(Bohnsack et al., 2014; Massa and Tucci, 2014; Smith, 2012; Teece, 2010; Tongur and Engwall, 2014; Veit et al., 2014), [S5], [S12], [S18-S19], [S23], [S26-S27], [S45], [S56-S57], [S61], [S75], [S80-S82], [S84], [S87], [S89], [S92-S93], [S102], [S116], [S119-S120], [S126], [S134-S135], [S146-S147], [S149], [S155], [S158], [S161], [IT02]
M5	y10	y5	Effects of moderator factors [M]	Low-skilled people	[M] **as measured by** the level of lack of people qualification (Ordinal Scale: 1..10)	You have experienced restraint or inhibition (or other limiting effects) on the business operations due the influence of lack of people qualification (e.g., education, skills, etc.).	(Bessant, 1995; Dewhurst et al., 2009; Fish, 2013; Goffee and Jones, 2007; OECD, 2012; VerBruggen, 2012), [S11], [S90], [S98], [S112], [S146], [NG02], [NG03], [NG10], [IT01], [IT02], [IT06], [IT09]
A1	y11	y6	Agile capabilities [A]	Flexibility	[A] **as measured by** the level of flexibility (Ordinal Scale: 1..10)	You have experienced circumstances where adjustment capability (adequacy) of business operations to handle with an unexpected situation (e.g., assimilating the change, having resilience to deal with it, etc.) was essential to ensure the performance of the organization and its projects.	(Jagodziski, 2010; Koste et al., 2004; Mandelbaum and Buzacott, 1990; Naim et al., 2010; Nascimento and Oliveira, 2013; Phillips and Tuladhar, 2000; Pulipati, 2012; Saari and Heikkila, 2008; Shuiabi et al., 2005; Su, 2012), [S4], [S10], [S29], [S31], [S34], [S43], [S52], [S76], [S80], [S88], [S89],

ID	#1[57]	#2[58]	Unit	Empirical Indicators	Metric description	Question for the survey instrument	References
							[S105], [S121], [S126-S128], [S132-S135], [S140], [S142], [S149-S150], [S154], [S159], [S164], [S166], [NG08], [IT01-IT03], [IT06], [IT09]
A1	y12	y7	Agile capabilities [A]	Leanness	[A] **as measured by** the level of leanness (Ordinal Scale: 1..10)	You have experienced circumstances where the capability "to do more with less" on business operations (e.g., eliminating waste, keeping the things simple, reusing resources, etc.) was essential to ensure the performance of the organization and its projects.	(Anvari et al., 2013; Chatwal et al., 2013; Chauhan, 2012; Diego Fernando and Rivera Cadavid, 2007; Glover et al., 2013; Hayata et al., 2012; Jørgensen et al., 2007; Malmbrandt and Åhlström, 2013; Marlow and Casaca, 2003; Ozelkan et al., 2013; Pulipati, 2012; Shah and Ward, 2007; Vinodh and Joy, 2012; Wan and Frank Chen, 2008; Womack, 2006), [S14], [S16], [S32], [S37], [S39], [S48], [S75], [S77], [S93], [S117], [S126], [S128], [S138-S139], [S146-S148], [S153], [S156], [S162], [S163], [S165], [S166], [NG03], [IT06-IT07], [IT09]
A1	y13	y8	Agile capabilities [A]	Agility	[A] **as measured by** the level of agility (Ordinal Scale: 1..10)	You have experienced circumstances where the capability "to react to changes faster than the rate of these changes" on business operations (e.g., anticipating change when possible, analyzing and reacting quickly to it, etc.) was essential to ensure the performance of the organization and its projects.	(Arteta and Giachetti, 2004; Faisal et al., 2007; Hayata et al., 2012; Joshi et al., 2013; Lappo and Andrew, 2004; Nascimento and Oliveira, 2012; Pulipati, 2012; Shawky and Ali, 2010; Smith, 2012; Tsourveloudis and Valavanis, 2002; van Oosterhout et al., 2006), [S4], [S84], [S89], [S123], [S124], [S126], [S128], [S132-S134], [S138], [S142], [S144], [S146], [S149], [S152-S155], [S157-S161], [S163], [S165], [S167], [NG02], [IT06]
A1	y14	y9	Agile capabilities [A]	Adaptability	[A] **as measured by** the level of adaptability (Ordinal Scale: 1..10)	You have experienced circumstances where the capability "to adapt evolutionarily" on business operations (e.g., it adjusting in an evolutive manner, developing new strategic features, adjustability, etc.) was essential to ensure the performance of the organization and its projects.	(Caligiuri, 2013; Chatwal et al., 2013; Folke et al., 2010; Hayata et al., 2012; Jagodziski, 2010; Jones et al., 1997; Krechmer, 2010; Nascimento and Oliveira, 2012, 2013; Pike et al., 2010; Reeves and Deimler, 2011; Su, 2012), [S4-S5], [S7], [S9-S11], [S13], [S15], [S19], [S21], [S23-S27], [S29-S30], [S32], [S36], [S39-S43], [S49], [S60], [S62], [S64-S65], [S67], [S69], [S76], [S80-S82], [S84-S85], [S87-S89], [S101-S102], [S104-S108], [S114-S115], [S120], [S124], [S126], [S128-S130], [S132], [S136], [S139], [S141-S142], [S144], [S149-S155], [S157], [S159-S160], [S162-S166], [NG02-NG03], [NG09], [IT06]
G1	y15	y10	Governance capabilities [G]	Strategic alignment	[G] **as measured by** the level of strategic alignment (Ordinal Scale: 1..10)	You have experienced circumstances where the capability "to ensure a continuous strategic alignment" on business operations (e.g., keeping the operations in line with the business strategy,	(Chakravarthy, 1986; Chan et al., 1997; Croteau and Raymond, 2004; Esmaili et al., 2010; Kaplan and Norton, 2004; Teece et al., 1997; Van Grembergen and De Haes, 2009), [S7], [S86],

ID	#1[57]	#2[58]	Unit	Empirical Indicators	Metric description	Question for the survey instrument	References
						doing the right thing, prioritizing initiatives, etc.) was essential to guarantee the achievement of the objectives of the organization and its projects.	[S137], [S141], [S145-S146], [S149], [S151-S155], [S160], [S165-S166], [NG01], [NG11], [IT07]
G2	y16	y11	Governance capabilities [G]	Decision making	[G] **as measured by** the level of decision making (Ordinal Scale: 1..10)	You have experienced circumstances where the capability "to ensure effective decision making" on business operations (e.g., reducing more complicated decisions down to simpler steps, weighing up the risks involved, weighing up the pros and cons of each course of action, etc.) was essential to guarantee the achievement of the objectives of the organization and its projects.	(Bennett et al., 2010; Eisenhardt and Zbaracki, 1992; Gigerenzer and Gaissmaier, 2011; Hansson, 2005; Joshi et al., 2013; Pulipati, 2012; Su, 2012), [S5], [S7], [S15], [S73], [S131], [S136-S137], [S139-S141], [S149], [S151-S152], [S156], [S161], [S163], [S171-S172], [NG03], [NG11], [IT01]
G3	y17	y12	Governance capabilities [G]	Control	[G] **as measured by** the level of control (Ordinal Scale: 1..10)	You have experienced circumstances where the capability "to ensure the strategy accomplishment" on business operations (e.g., establishing mechanism, policies, accountability, etc.) was essential to guarantee the achievement of the objectives of the organization and its projects.	(Armour, 2012; Boyd, 1994; Eisenhardt, 1985; Joshi et al., 2013; Powell et al., 2001; Smith, 2012), [S8], [S60-S112], [S114-S121], [S123-S132], [S134-S137], [S139-S147], [S149-S158], [S160-S167], [NG02], [NG03]
G4	y18	y13	Governance capabilities [G]	Compliance	[G] **as measured by** the level of compliance (Ordinal Scale: 1..10)	You have experienced circumstances where the capability "to ensure regulatory compliance status" of business operations (e.g., complying with organizational policies, legislation, international standards, market rules, etc.) was essential to guarantee the achievement of the objectives of the organization and its projects.	(Lu et al., 2008a, 2008b; Schneider et al., 2013; Sommers et al., 2007; Weidlich et al., 2011), [S2], [S4], [S6], [S8], [S82], [S131], [S142], [NG02], [NG03], [NG06], [IT05]
B1	y19	y14	Business operations [B]	Business process driven approach	[B] **as measured by** degree of process approach for business (Ordinal Scale: 1..10)	You have experienced circumstances where the capability "to establish and implement business processes" to business operations (e.g., ensuring the reproducibility of business operations, supporting business goals, ensuring business continuity, etc.) was essential to guarantee the continuity of supply of products and/or services.	(Aalst et al., 2003; Abdolvand et al., 2008; Chen et al., 2013; Elbashir et al., 2008; Ghose and Koliadis, 2007; Glover et al., 2013; Huang et al., 2012; Joshi et al., 2013; Ko et al., 2009; Schmiedel et al., 2014), [S1-S9], [S12-S13], [S16], [S19-S21], [S23], [S28-S29], [S31-S32], [S34], [S36], [S39-S41], [S43], [S46], [S48], [S50], [S53], [S58-S59], [S64], [S68], [S70], [S75-S76], [S82-S83], [S87-S90], [S93], [S96], [S98], [S102], [S104], [S106], [S108], [S115], [S117-S118], [S120], [S124], [S128-S129], [S134-S135], [S142], [S147], [S149], [S152], [S154], [S157-S159], [S161-S162], [S164-S165], [NG02], [NG03], [NG07]
B2	y20	y15	Business operations [B]	Projects driven approach	[B] **as measured by** degree of project-based approach for business transitory aspects (Ordinal Scale: 1..10)	You have experienced circumstances where the capability "to establish and implement a project-based approach" for (transitory aspects of) business operations (e.g., dealing with service	(Bower and Finegan, 2009; Hayata et al., 2012; Koelmans, 2004; Lacerda et al., 2011; Luu et al., 2008; Nascimento and Oliveira, 2012; Okudan and Rzasa,

ID	#1[57]	#2[58]	Unit	Empirical Indicators	Metric description	Question for the survey instrument	References
						transition, applying to change management, to produce new product/service, etc.) was essential to guarantee the continuity of supply of products and/or services.	2006; Vidal et al., 2011; Xu and Yeh, 2014), [S1-S3], [S5], [S14], [S16-S17], [S20], [S22], [S27], [S32], [S42], [S44-S45], [S52], [S54], [S56], [S60], [S62], [S66], [S68-S70], [S72], [S75], [S77], [S79-S80], [S85], [S87], [S90-S92], [S94], [S98-S100], [S103], [S106-S110], [S112], [S114-S115], [S119], [S112-S124], [S127], [S132], [S136-S139], [S141], [S143], [S148], [S151], [S160], [S163], [S165], [NG02], [NG03], [NG06], [NG08-NG11]
B3	y21	y16	Business operations [B]	Best practices adoption	[B] **as measured by** degree of best practices adoption for business (Ordinal Scale: 1..10)	You have experienced circumstances where the capability "to establish and implement best practices" on business operations (e.g., organizational learning, benchmarking, etc.) was essential to guarantee the continuity of supply of products and/or services.	(Ahmed et al., 1999; Cormican and O'Sullivan, 2004; Glover et al., 2013; Johnston and Mehra, 2002; Joshi et al., 2013; Nascimento and Oliveira, 2013; Ozelkan et al., 2013; Richard et al., 2009; Su, 2012), [S3-S4], [S13], [S16], [S19], [S22-S23], [S28], [S42], [S44-S45], [S50], [S53], [S58], [S60-S62], [S66], [S75], [S79-S80], [S82], [S85], [S87], [S90-S92], [S96], [S98-S99], [S101-S102], [S107-S108], [S114-S117], [S119], [S122-S126], [S128-S129], [S131-S136], [S138], [S140-S141], [S143], [S145-S147], [S149], [S151], [S153], [S158], [S159], [S161-S165], [S167], [NG02]
R1	y22	y17	Value delivery [R]	Utility for product or service	[R] **as measured by** the grade of utility embedded in products or services (Ordinal Scale: 1..10)	You have experienced circumstances where the "embedding of utility concept for products or services" (e.g., making it fit for purpose, making it for meet the audience desire, etc.) led to increase value delivery (e.g., satisfaction, better acceptance, etc.) for target audience (customers, citizens, etc.).	(Cronin and Taylor, 1992; Druehl and Porteus, 2010; Hao et al., 2012; Lamparter et al., 2005; OGC, 2007d; Ruiz et al., 2008; Yeo et al., 2010), [S5], [S7], [S11], [S18-S19], [S36], [S46], [S62], [S78], [S82], [S101], [S106], [S115-S118], [S133], [S140], [S155], [S165], [IT01-IT09]
R2	y23	y18	Value delivery [R]	Warranty for product or service	[R] **as measured by** the grade of warranty embedded in products or services (Ordinal Scale: 1..10)	You have experienced circumstances where the "embedding of warranty concept for products or services" (e.g., making it fit for use, keeping it available for use, ensuring the required performance, etc.) led to increase value delivery (e.g., satisfaction, better acceptance, etc.) for target audience (customers, citizens, etc.).	(Hogan et al., 1984; Jagodziski, 2010; Jia et al., 2008; Jiang and Zhang, 2009; Rust and Huang, 2012), [S1], [S7], [S9-S10], [S16], [S21], [S32], [S45-S47], [S52], [S57], [S60], [S61], [S63], [S75], [S80], [S83-S84], [S89-S91], [S102], [S105], [S112], [S114-S115], [S118], [S121], [S133], [S140], [S142], [S145], [S151], [IT05], [IT09]
R3	y24	y19	Value delivery [R]	Time-to-market for product or service	[R] **as measured by** the degree of time-to-market of products and services (Ordinal Scale: 1..10)	You have experienced circumstances where the "development of mechanisms to reduce time-to-market of products or services" (e.g., quick release, continuous improvement, etc.) led to increase value delivery (e.g., satisfaction, better	(Gonçalves et al., 2000; Jagodziski, 2010; Labriola, 2007; Lings and Greenley, 2010; Mahmoud-Jouini et al., 2004b; O'Hara and Ye, 2011; Perols et al., 2013), [S4], [S13], [S21], [S43-S44], [S60], [S73-S74], [S89-S90],

ID	#1[57]	#2[58]	Unit	Empirical Indicators	Metric description	Question for the survey instrument	References
						acceptance, etc.) for target audience (customers, citizens, etc.).	[S101], [S109], [S114-S117], [S129], [S134], [S136-S137], [S140], [S141], [S144], [S151], [S153], [S161], [S163]

Due the method chosen to test the hypotheses (SEM and CFA[59]) we had to define more than one empirical indicator for each theory unit. Despite the intellectual effort and energy involved on that endeavor, the significant number of empirical indicators will lead us to a more consistent based-evidenced study to assess the emerging theory.

Furthermore, we would like to clarify that the set of empirical indicators adopted to carry on this kind of empirical assessment can (and should) be adjusted according the organizational context studied. In the current case, we seek define a set of empirical indicators generic enough to assess the wide spectrum of organizational contexts chosen (see the beginning of the Section 4.5.2), while they were thought to be consistent enough to represent the constructs and assess the plausibility of the emerging theory. The recent experience conducting the survey that will be described in details in Chapter 5, lead us to believe that how much more specific are the indicators chosen, the better will be the result of the study. Usually, the set of indicators identified in this study can a useful reference for future work on it.

In conclusion, this Section presented the empirical indicators identified to measure the values of the units in the theory. We have identified 24 empirical indicators, as follows:

i. Five empirical indicators for both *Effects of environmental factors* [E] and *Moderator factors effects* [M];
ii. Four empirical indicators for both *Agile capabilities* [A] and *Governance capabilities* [G]; and,
iii. Three empirical indicators for both *Business operations* [B] and *Value delivery* [R].

The next Section will develop hypotheses that leverage these empirical indicators to test the theory's propositions in the real world.

[59] We are mentioning about Structural Equation Modeling and Confirmatory Factor Analysis, respectively. See details in Chapters 2 and 5.

4.4.3 STEP 7: Establishing testable Hypotheses

The previous six steps in the theory-building research process have allowed for the conceptual development of a *theoretical framework* (step 1 to 4), the specification of *proposition* statements (step 5), and the identification of *empirical indicators* for the model that represents the ongoing theory (step 6). At this point, conforming (Tuttle, 2003), testing in the empirical world is already possible (Dubin, 1978). This Section develops *hypotheses* for the theory. These *hypotheses* allow for the testing of *predictions* in the real world.

Hypotheses are intended to test predictions in the real world. As stated by Dubin: "*It is through the test that [the researcher] relates the facts he finds in the empirical world to his theoretical predictions about them. We can safely assume, therefore, that the hypothesis is the feature of a theoretical model closest to the 'things observable' that the theory is trying model*," (1978, p. 205). Hypotheses are defined as *predictions concerning the values* of a theory's units in which empirical indicators are employed for the names of the units in each proposition. Dubin (1978) points out two criteria of import in constructing hypotheses of the theory.

Table 4.21 – Dubin's relevant criteria in constructing hypotheses of the theory. Source: Adapted from Dubin (1978).

Criterion	Description
Homology	First, he stated that "*every hypothesis is homologous with the proposition for which it stands*" (p. 207), indicating homology between the hypotheses and their corresponding propositions as a necessary criterion of excellence for this seventh step in the theory-building process.
Validity	Second, he stated that to determine hypotheses, the researcher-theorist must identify the necessary and sufficient conditions of each unit of the theory. These necessary and sufficient conditions of each unit of the theory are obtained from the definition, and component parts, of each unit of the theory.

In fact, the empirical indicators in the hypothesis standing in for the names of the units in the proposition have to meet the necessary and sufficient conditions of the theoretical defined unit. These conditions were articulated in the preceding Section on identifying *empirical indicators*.

In constructing the hypotheses of the theory, the researcher-theorist is confronted with a decision of quantity; that is: "*How many hypotheses are enough for testing the theory?"* (Dubin, 1978) offered some noteworthy insights in this regard.

First, Dubin suggested that "*every proposition [in the theory] has the potential of being converted to a large number of hypotheses*" (1978, p. 208). On this point, he proceeded to say

that "*the general rule is that a new hypothesis is established each time a different empirical indicator is employed for any one of the units designated a proposition*" (p. 209). He correspondingly further indicated that "*this rule establishes the fact that the number of hypotheses is rapidly expanded as skill and imagination are utilized in developing empirical indicators*" (p. 209).

Second, Dubin (1978) did suggest that not all propositions of the theory need to be converted to hypotheses: "*There is no logic that insists that only those [theoretical frameworks] whose propositions are all testable should be employed in science. Indeed this restriction, representing the extreme positions of operationalists, has proved needless. All theoretical [frameworks] need to be testable by converting at least some of their propositions to hypotheses. It is not a requirement, however, that all propositions of a [theoretical framework] be testable.*" (p. 209). Ultimately, this question of a sufficient number of hypotheses, according to Dubin: "*poses a question of research efficiency"* (p. 209).

It is therefore clear that various strategies may be employed in the formulation of hypotheses, and these strategies are usually chosen in accordance with available research time and resources. Dubin (1978) and Tuttle (2003) suggest three primary strategies may be employed to develop hypotheses to test. They are depicted in **Table 4.22**. Dubin warns that these three strategies for hypotheses development are not mutually exclusive nor is one any better than the others.

Table 4.22 – Dubin's strategies to develop hypotheses. Source: Adapted from Dubin (1978) and Tuttle (2003).

Strategy	Description
Extensive	The extensive strategy entails developing hypotheses to test every strategic proposition in a theoretical model. Because the extensive approach tests all strategic propositions, the strategy is "*the most adequate test of the theory as a whole*" (Dubin, 1978, p. 210).
Intensive	Alternatively, the intensive strategy entails focusing attention on one or more, but not all, of the theory's strategic propositions. The intensive strategy may be appropriate if the researcher has a particular interest in a limit number of strategic propositions (Dubin, 1978) or *if the resources available for research are limited*.
Inductive	Finally, the inductive strategy entails starting with an ad hoc hypothesis and working backwards to identify the other components of the theoretical model (Dubin, 1978; Tuttle, 2003).

An **intensive strategy** was chosen for the development of the theory's hypotheses. The intensive approach was selected because research is resource intensive (Dubin, 1978; Tuttle, 2003). As stated by Dubin: "*many scientists are relatively reluctant to do research because of the time and energy required and the often routine character of the operations involved. Given, then, the possibility of doing trivial research and the considerable investment necessary to*

accomplish any single piece of research, these constitute strong pressures toward achieving some degree of efficiency in research operations." (1978, p. 209).

Table 4.23 – Theory's hypotheses: summary of classification. Source: Own elaboration.

ID	Category	Hypothesis statement	Traceability
H1	Agile governance	The agile capabilities [A] have a positive influence on governance capabilities [G].	P1, P2, L1
H2	Agile governance	The governance capabilities [G] have a positive influence on business operations [B].	P1, P2, L1
H3	Specific agility	The agile capabilities [A] have a positive influence on business operations [B].	P1, P2, L2
H4	Value delivery	The business operations [B], under influence of agile capabilities [A] and governance capabilities [G], have a positive influence on value delivery [R].	P1, P2, P3, L1, L6
H5	Moderator factors effects	The effects of moderator factors [M] have a *negative influence* on business operations [B].	P4, P5, P6, L3
H6	Environmental factors effects	The effects of environmental factors [E] have a *negative influence* on business operations [B].	P4, P5, P6, L4
H7	Moderator factors effects	The effects of moderator factors [M] have a *negative influence* on agile capabilities [A].	P4, P5, P6, L3
H8	Moderator factors effects	The effects of moderator factors [M] have a *negative influence* on governance capabilities [G].	P4, P5, P6, L3
H9	Environmental Factors effects	The effects of environmental factors [E] have a *negative influence* on agile capabilities [A].	P4, P5, P6, L4
H10	Environmental factors effects	The effects of environmental factors [E] have a *negative influence* on governance capabilities [G].	P4, P5, P6, L4
H11	Environmental factors effects	The effects of environmental factors [E] have a positive influence on effects of moderator factors [M].	P4, P5, P6, L4
H12	Sustainability	The agile capabilities [A] have a positive influence on effects of moderator factors [M].	P2, P5, P7, L5
H13	Competitiveness	The agile capabilities [A] have a positive influence on effects of environmental factors [E].	P2, P5, P7, L5
H14	Sustainability	The governance capabilities [G] have a positive influence on effects of moderator factors [M].	P2, P5, P7, L5
H15	Competitiveness	The governance capabilities [G] have a positive influence on effects of environmental factors [E].	P2, P5, P7, L5
H16	Agile Governance mediation	Governance capabilities [G] positively and partially mediate the relation between agile capabilities [A] and business operations [B].	P1, P2, L1

The researcher-theorist chose to focus development on hypotheses dealing with the *theory's most representative strategic propositions*, based on the interaction among its units, *in order to assess theory plausibility*. By focusing the development of hypotheses on those propositions, the researcher-theorist seeks the most *parsimonious approach* to corroborate or identifying the need to modify the theory. Each hypothesis was described as simply as possible to facilitate its test by Structural method Equation Modeling (SEM) and Confirmatory Factor Analysis (CFA). So that, in most case we have one proposition generating more than one hypothesis.

Sixteen hypotheses for this theory were developed. These hypotheses are focused on the theory's central propositions: *proposition one to five* (see **Table 4.17**). While propositions six to

eleven are untested, they concern the continuity of the theoretical model's system states. Despite those not chosen propositions are important (6 to 11), testing these selected propositions (1 to 5) will help to establish the underlying logic upon which the system states are based (test by inference). Consequently, an investigation of these first five propositions is more important to testing the theory, at this time.

The hypotheses developed adhere to Dubin's (1978) guidelines. During the hypotheses development we followed the criterion of *homology* and *validity*. The theory's sixteen hypotheses are presented in **Table 4.23**.

We also elaborated the Theory's Hypotheses diagram depicted in **Figure 4.13** to facilitate de identification of each hypothesis. An attentive reader will observe that the hypothesis H16 is not depicted explicitly in **Figure 4.13**. Indeed, H16 is the subsystem comprised by H1, H2 and H3.

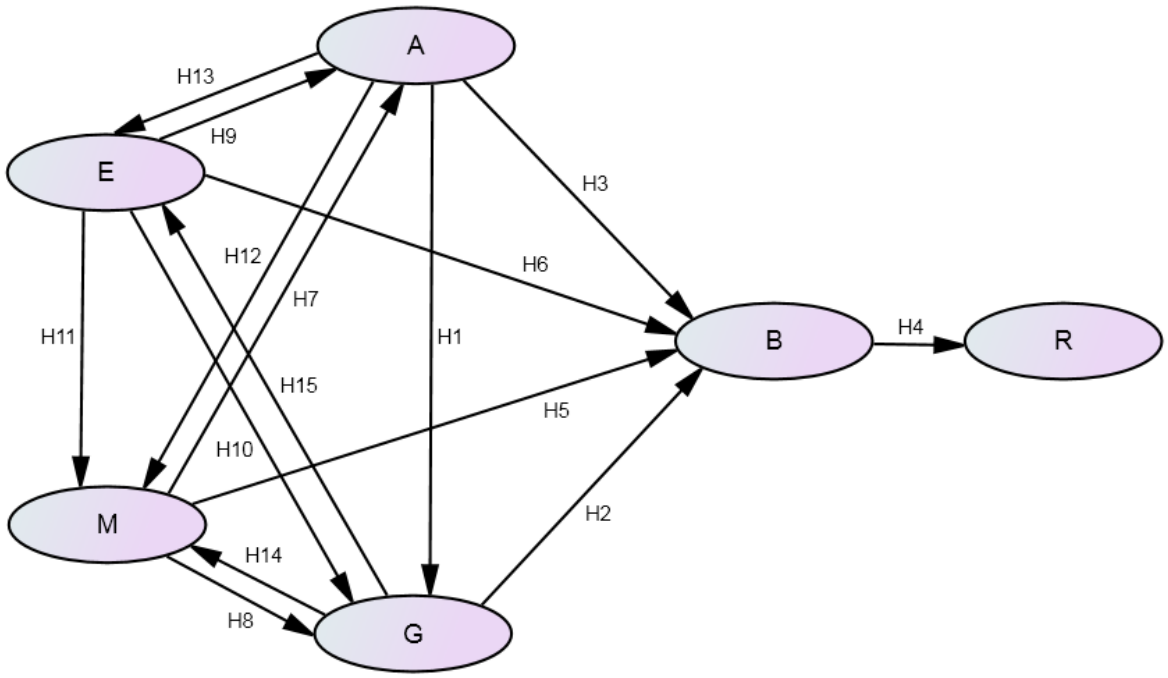


Figure 4.13 – Theory's hypotheses: visual characterization. Source: Own elaboration.

This **Figure 4.13** only represents the whole picture of the hypotheses to be tested to assess the plausibility of emerging theory, but these hypotheses will be tested in particular setting (or combination), which we name of theoretical scenarios. Those scenarios will be discussed in details at Section 4.5.3. These hypotheses provide the means to test the theory in the real world. The next Section describes a research agenda that could be used to conduct these tests.

4.4.4 STEP 8: Framing an Empirical Study to test the strategic Hypotheses

This eight and final step in the methodology is conducting tests of the theory's hypotheses to test the theory in an effort to modify and refine it.

As stated by (Cohen, 1989), the evaluation of theories involves both logical and empirical standards (Bunge, 1967; Cohen, 1989; Dubin, 1978). However, they claim that in order to be able to evaluate the *goodness* of a theory, we must first establish the criteria by which it is to be evaluated. Several such criteria are described in the literature (Popper, 2005). Which criteria one adheres to depends on the type of theory one is attempting to generate, as well as on the framework of generation one is adhering to. The hypothetical-deductive theory building methods (such as Dubin's method) sees the criterion of *falsifiability* (Marôco, 2014), as the demarcation criterion between science and non-science. It assumes the presence of a falsifiable theory, which gives rise to hypotheses that are tested by observation. Often, when scientists talk about *testability*, they have something like *falsifiability* in mind. But testing a theory against the world turns out to be more complicated than testing a single, isolated hypothesis. So, test the theory will take *multiple research studies* to fully address this endeavor.

Therefore, in order to the proposition *assess the plausibility* of the theory we will design an empirical study guide by a research agenda, described in details in Section 5.2 of the next chapter.

4.4.5 Conclusion to Part Two: the Research Operation of the theory

The outcome of Part Two of the theory building research process, research operation, is an *operationalized theory* (Dubin, 1978). Research operation entailed the following steps: specifying *propositions* of the theory, identifying *empirical indicators*, developing *hypotheses*, and building a proposed *research agenda* to test the theory.

Each of seven of these steps has been completed, plus the eighth step will be detailed in Section 5.2. This concludes Part Two of the theory building research process. The next steps in this study are: (1) assess "*Agile Governance Theory*" using established criteria; and, (2) discuss

the theory's implications for research and practice. The prior topic will be detailed in Section 5.2, while the later one is the focus of the following Sections.

4.5 THEORY ANALYSIS – Playing with the theory

This Section addresses the intellectual exercise of the emerging theory, to what we irreverently call "playing with the theory". Using the words of Gregor (2006) and Sjøberg et al. (2008) we will analyze the system created by the emerging theory discussing its application, behavior, usefulness and consequences using the theoretical lens of Dubin (1978, 1976) and disciplined imagination of Weick (1989). It is important to highlight that the theory version discussed from this point is the final version of this work, after the empirical assessment introduced in Section 4.4.4, and detailed in the Section 5.2, as well as after the comparison with other theories, carried out in Section 5.3. Have a good time!

4.5.1 System Analysis

There are a number of ways to define and characterize a system. For example: "*a system is a set of objects together with the relationships between their objects and between their attributes*" (Hall and Fagen, 1968).

As pointed out by Dubin (1978, pg. 240), with this way of characterizing a system, analysis of the system can focus on the whole system rather than on its parts. The analytical consequences are that one can reach conclusions about the system that could not be reached from knowledge of its parts. According to Bertalanffy (1972), the meaning of the mystical expression "*the whole is more than the sum of parts*" is simply that constitutive characteristics are not explainable from the characteristics of isolated parts. The characteristics of the complex, therefore, compared to those of the elements, appears as "new" or "emergent". Whether, however, we know the total of parts contained in a system and the relations between them, the behavior of the system may be derived from the behavior of the parts.

Although intuitively, this premise has motivated the development of the Sections that follows. Making an pleasant analogy, if in the previous Sections (4.3 and 4.4) we have reported how we built the ship, describing each part that compose it, their characteristics and behaviors. Now we

will embark on this ship and travel towards the analysis of the theory application based on facts and allegories from the real world.

Considering the system described by this theory, depicted in **Figure 4.12**, its conceptual framework, the *organizational boundary* separates the internal environment from the external environment, characterizing the *organizational context* [O]*,* i.e., a variable that we need to account for, but that does not drive our theory. The organizational context is an important variable that shall be deeply discussed in Section 4.5.2 in order to interpret and perform the theory in several backgrounds, such as: a team, a project, a business unit, whole enterprise, or even a multi-organizational setting.

In turn, many disturbing factors from the external environment [E], symbolized by the large red arrows that point in the direction of organizational context [O] in **Figure 4.12**, can interact among themselves influencing the internal environment in different ways. The *environment's nature* [N] is a meaningful variable, because it can describes the level of competitiveness, regulation influence, unpredictability, uncertainty, opportunities, and threats, just to cite few factors, depicting the nature of the environment where the organizational context is inserted.

The gray arrows, in **Figure 4.12**, connecting constructs describe the causality between each one of them. Those interactions were described by the Laws detailed in Section 4.3.2. While the External Environment's Factors [E] act upon the system boundary causing *disturbing effects* on every construct that belong to the organizational context [O], the agile capabilities [A] performs a partially mediation of the effect received from the external disturbing factors [E] on each one of the other constructs: i) attenuating the effects of the moderators factors [M]; ii) potentiating governance capabilities [G]; and iii) empowering business operations [B]. In turn, the effects from moderators factors [M] restrain either governance capabilities [G] at the same time that exerts a limiting effect on business operations [B], although this effect is mediated by the governance capabilities [G]. Once for all, the governance capabilities [G] contribute to support business operations [B] by means of the effective steering the organization.

At the same time, we can notice in **Figure 4.12** the black arrows pointing in the direction of external environment. These arrows mean the results of the organizational context [O], i.e., the value delivery [R] by the business operation [B] outcomes of the subsystem comprised into the organizational boundary. Based on that, we are depicting the reference schema of this theory as an open system, justified by this "permeability" described in terms of the ability to assimilate

and respond to changes in a volatile and dynamic external environment. This kind of approach is pretty aligned with some authors such as (Takwale and Puranik, 1979). However, this work has a main focus on the aspects that occurs as a consequence from the influence of the external aspects upon the internal environment (organizational context) and its consequences and developments.

4.5.2 Organizational context and theory instantiation

In **Figure 4.12**, when the **organizational boundary** (red dashed edge) delimits the internal environment, separating it from the external environment, it characterizes the concept of *organizational context* [O].

This concept works as a *control variable* of the theory, i.e., a factor that remains unchanged and strongly influences resulting values of the constructs; also, a factor held constant to test the relative impact of an *independent variable*: but it does not drive our theory.

In other words, control variables could influence the values of the constructs, but it does not change the operating logic of the theory, neither the causality among the (Creswell, 2003).

The **organizational context** [O] is a variable in our theory that can assume different values, such as: (1) a teamwork; (2) a project; (3) a business unit; (4) an entire enterprise; or even, (5) many institutions collaborating with each other in a multi-organizational setting.

We will refer those values as **levels of organizational context** according to their complexity: beginning the teamwork context as the lower level, and increasing gradually the complexity until reach the greater level of complexity, as the multi-organizational context. In addition, the application of theory in each organizational context will be named **theory instance**.

For instance, **Figure 4.14** depicts an illustrative scenario, where as a matter of simplicity each theory instance was represented as an ***organelle***[60]. In other words, an *organelle* is a simplified version of the *conceptual framework of the theory* depicted in **Figure 4.12**, as a streamlined schema of the theory, hiding the *constructs* and the *interactions* between them, but keeping the essential components to the discussions that follow.

[60] A simplified manner to represent graphically a theory's instance.

On that scenario we can apply the theory in two different projects (P_1 and P_2) that belong to a same business unit (B_1), as well as apply the theory simultaneously to the business unit containing them (B_1). That business unit (B_1) is contained in a company (C_1), which in turn operates in a market (X_1).

In that case, the external environment (E_{P_1} and E_{P_2}) to be considered for the theory application on two mentioned projects should be the environment of the business unit, ($E_{P_1} = (C_1 - P_1) \cup X_1$) and ($E_{P_2} = (C_1 - P_2) \cup X_1$), which containing them, while the external environment (E_{B_1}) to be considered for the business unit should be the company environment (C_1) where it is contained, i.e., ($E_{B_1} = (C_1 - B_1) \cup X_1$). We also, can consider that the project (P_1) is conducted by three teams (T_1, T_2 and T_3), while the other project (P_2) is carried out by other two teams (T_4 and T_5). Similarly, the identification of the external environment for each instance of the theory must be applied as done for P_1, P_2 and B_1.

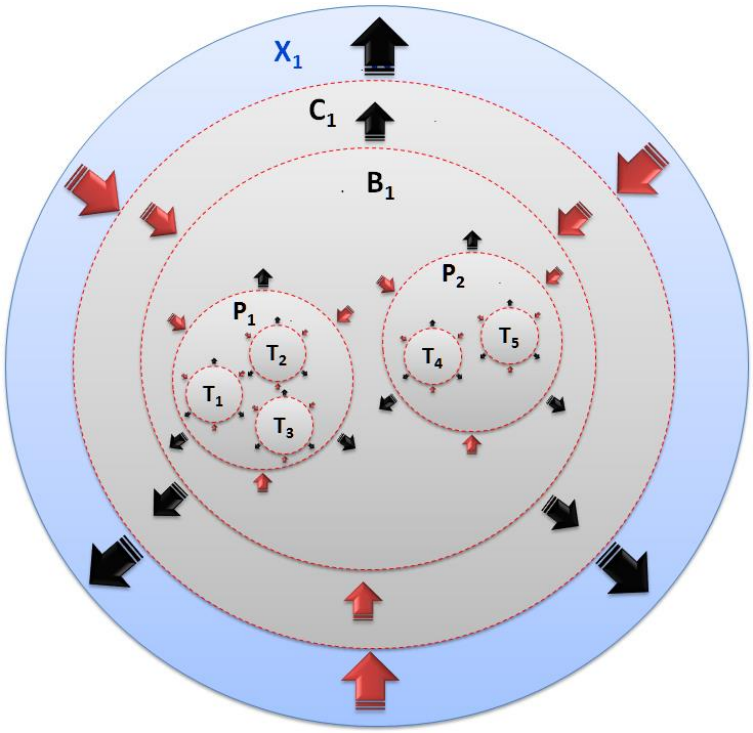


Figure 4.14 – Organizational context: multiple instances in a single enterprise. Source: Own elaboration.

It is inevitable to think that the most inner *organelles*, i.e., theory instance applied in a lower level of complexity, such as T_1, might be influenced by the disturbing factors from the external environment (X_1), as well as from the enterprise (C_1) in a diluted manner. Although other disturbing factors from the external environment of each level of organizational context which contains it (P_1, B_1 and C_1), can be added to the external disturbing resultant factors of the theory instance in question.

For example, a sudden change in the exchange rate of a foreign currency, an external factor to the enterprise (C_1) from the market where it is inserted (X_1), can also affect a team (T_1). To make it happen, just that they have budgeted the cost of acquisition of some inputs (e.g., external software component or hardware device) for the project activities (P_1) in foreign currency, while they are billing the customer in local currency. Or even if they have subcontracted some service in foreign currency, although the project is being paid in local currency.

In each of these contexts the theory should be applied according the same general descriptions, but respecting the particularities of each organizational context. Moreover, we believe that the theory can be applied in a coordinated manner in different levels of organizational context, in a large number of possible combinations.

4.5.3 The big picture: instancing the theory

On this Section we will instantiate one application of the emerging theory, in order to facilitate the understanding of its amplitude, resolution and utility.

Althought, in some instances of organizational setting we can have a single big project encompassing many teams, as is the case of projects that handle with different areas of the human knowledge. In practice most projects are multidisciplinary, even in Software Engineering; we have experts in distinct topics, such as: architecture, implementation, software testing, business domain, etc. This organizational setting was depicted in **Figure 4.9**, at Section **4.3.3**. The point here is: the choice of the unit of analysis for theory's exercise depends on the goal of its application.

In the instantiation described at this section we will consider the theory application in the teamwork organizational context, from a team that participates in some projects, inside a business unit at an enterprise. In other words, we will consider "the team" as the organizational context, i.e., the "unit of analysis", under study. The **Figure 4.15** illustrates the organizational context.

We will use the representation of the conceptual model of Agile Governance Theory from **Figure 4.12**, in a simplified form as depicted in **Figure 4.13**, to help the reader to understand the discussion that follows about this theory instantiation, seeking to represent step by step the

behavior of variables (theory units), laws and system states, compassed by the theory boundaries.

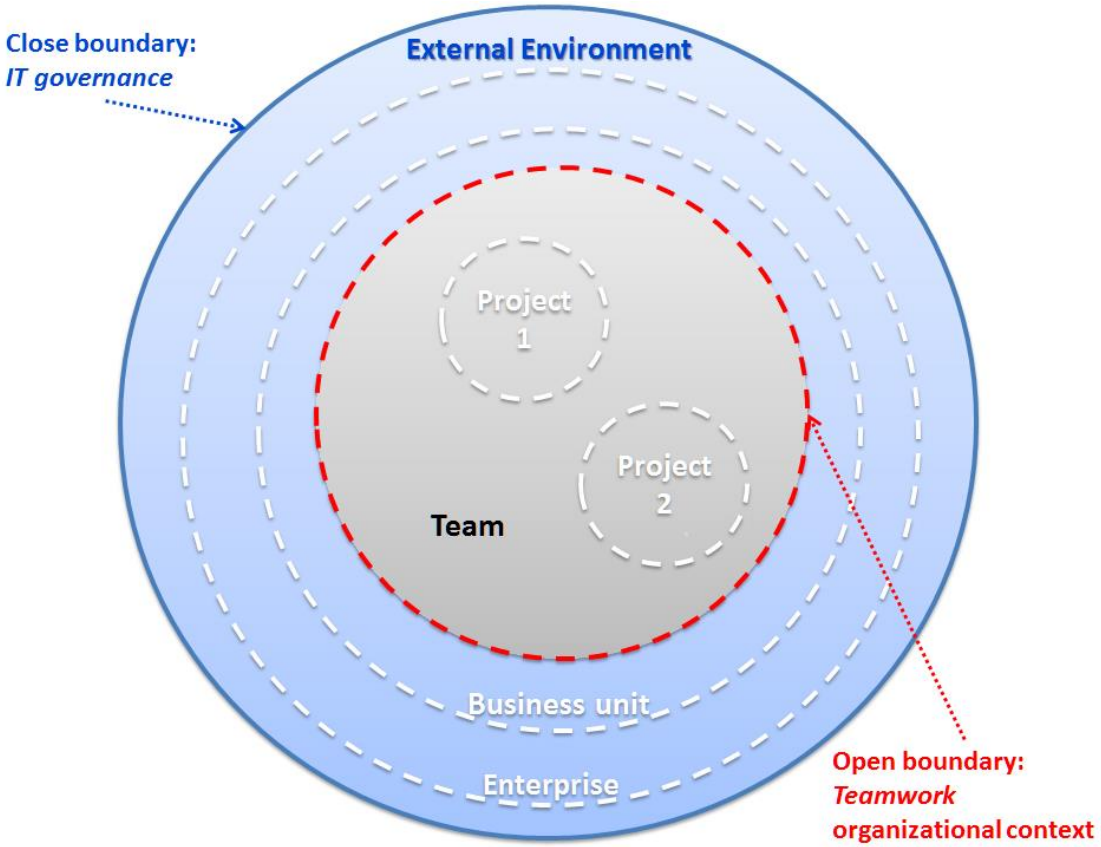


Figure 4.15 – Theory instantiation for teamwork. Source: Own elaboration.

4.5.3.1 Beginner Scenario (φ_0)

At beginning, we will also consider that the team under analysis has no experience about governance, neither an agile or lean culture previously established. Those characteristics lead us to classify this team in a macro-system state pre-theory described as "*Beginner*" (MS1) from **Figure 4.10**. In order to depict the characteristics described by this macro-system state, we draw the *theoretical* **scenario (φ_0)** portrayed in **Figure 4.16**.

At this system state, the team has no agile capability [A], neither governance capability [G]. The effects from external environment [E] (outside of the team, from: business unit, enterprise or outside the organization) are felt directly by business operations [B] and indirectly by means of the restraining performed by the effects of the moderator factors [M] of the team, in its inner context.

In this example we will consider a software development team responsible by two projects, comprising one project of a new software product (P1) and another project related to the

maintenance of other software product (P2). However, we would report an experience of a big project involving many teams. This leads us to infer the flexibility of the theory approach according to the configuration and relevance of the organizational context under study.

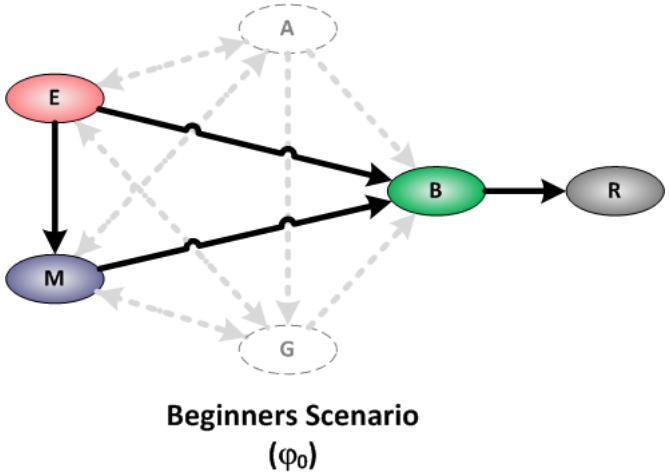


Figure 4.16 – Beginner Scenario (φ_0). Source: Own elaboration.

Turning back to our example, at the beginning (φ_0) the team does not have agile or lean culture, as a consequence they are not able to develop at this stage any agile competency, i.e., they have no agile capability [A=0]. Also they have no governance experience, not being able to develop any governance competency, i.e., they have no governance capability [G=0]. Due that, these constructs are shown with dotted lines in **Figure 4.16**.

The team members might even know about agile or lean, and governance experiences, from literature, report from other teams, courses, or other sources. However, the **ability to develop competencies** take account three essential pillars: (i) **knowledge**: "To know what and why to do"; (ii) **skill**: "To know how to do"; and, (iii) **attitude**: "To wish to do". When the organization provides a course about these topics, or the team members (by themselves) seek to improve their own knowledge about these matters, they are only addressing the first pillar. When the company hires a coach to help the team to evolve on those topics combining knowledge acquired and practices in their day to day context, in order to develop team skills, they are still addressing the two first pillars. The third pillar to become able to develop new competencies is, perhaps, the most difficult to achieve and develop: people's engagement.

Regardless, the team members are under the **effect of many disturbing factors [E] from the environment** where they are placed: business unit context, enterprise context, or even the market for which they develop and maintain software products. The effects of the environmental factors [E] upon organizational context are described by the **Law 4**, which is

detailed in Section **4.3.2.4**. In this **scenario (φ_0)**, the effects of those factors are depicted in **Figure 4.16** by the black arrows connecting the construct [E] to the constructs [M] and [B].

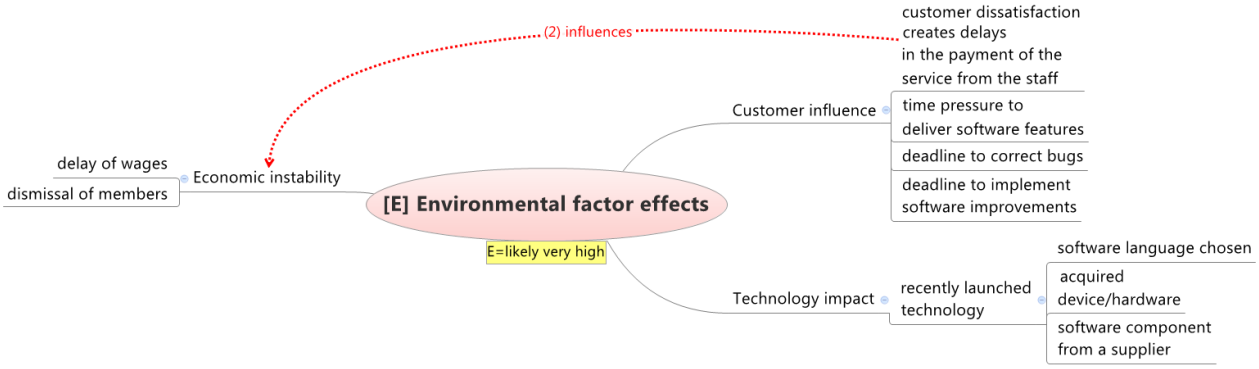


Figure 4.17 – Beginner Scenario (φ_0): illustrating instantiation of [E]. Source: Own elaboration.

As summarized in **Figure 4.17**, we can suppose, for instance, the team is under the *time pressure exerted by the customer to deliver new software functionalities* of the project of the new software product (P1), and/or they have a *deadline or an agenda (backlog) to fix some bugs and/or implement some improvements in the software product that they maintain* (P2). Both of these examples can be classified as "*customer influence*", generating stress to the team (arrow 1 in **Figure 4.18**). On the other hand, team members may be feeling threatened by the "*economic instability*" *caused by the delay of wages*, e.g., because of the failure of previous project deliveries the customer did not pay for the services (arrow 2 of the **Figure 4.18**), and the company for being small, had no financial backing to keep their financial commitments on time.

Other example of this kind of disturbing, might be illustrated by *notices from other teams/projects (by means of hallway conversations) about dismissal of members in projects that go through similar situation*. All these *influences have a devastating effect over the team morale*; can lead team to a lethargic state (e.g., discouragement, lack of motivation, lack of cohesion, members looking for jobs in other companies), as predicted by the micro-system state "*Lethargy"* (S1) depicted in Section **4.3.4**.

In complement, the team has its own limitations, and these disadvantages can be understood as the **effects of moderator factors [M]**, which in turn generate attenuation (or limiting) effects on teamwork performance. Further, the effects of the moderator factors [M] on organizational context are characterized by the **Law 3**, which is detailed in Section **4.3.2.3**. In this **scenario (φ_0)**, the effects of those factors are depicted in **Figure 4.16** by the black arrows connecting the construct [M] to the construct [B].

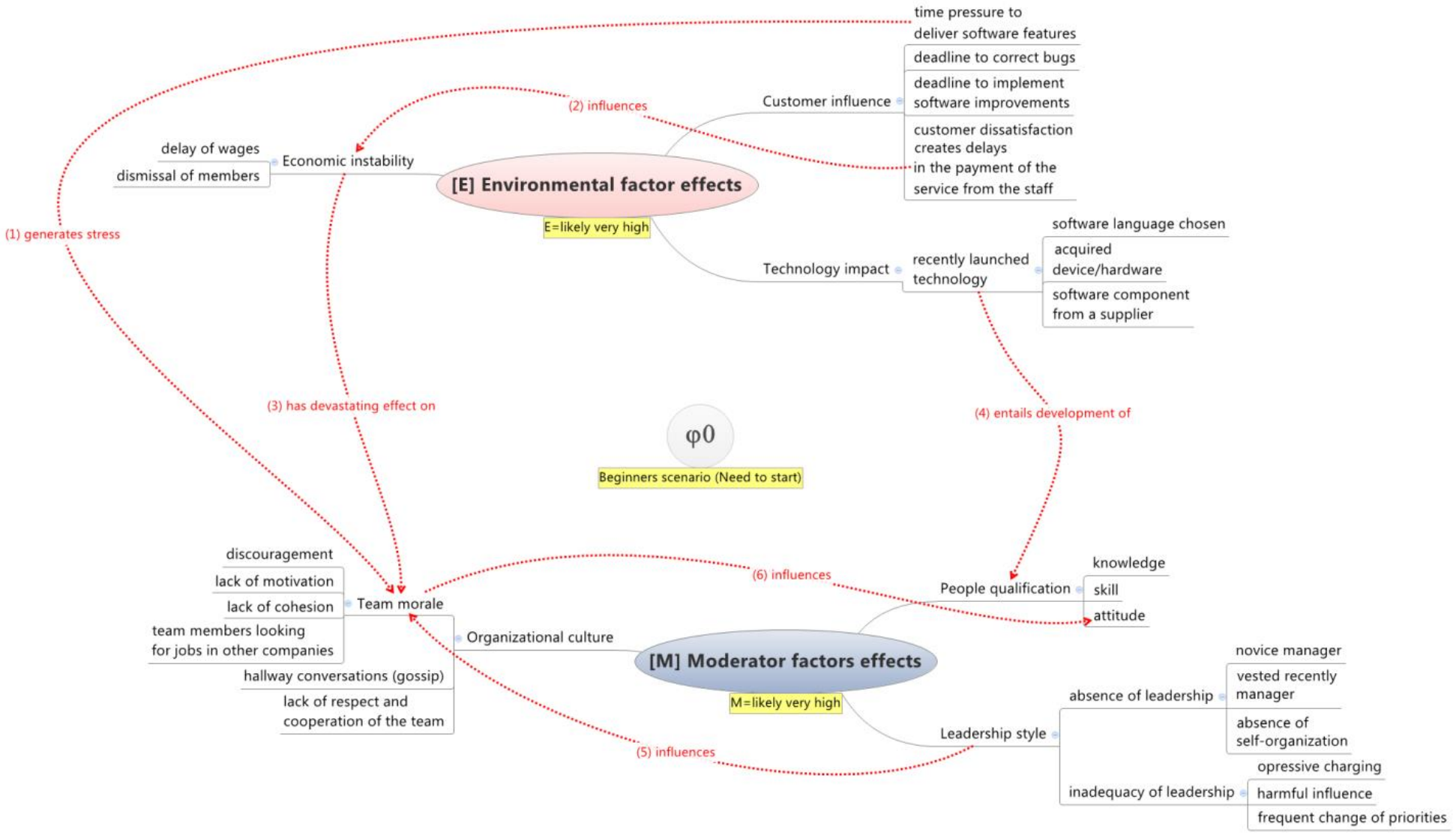


Figure 4.18 – Beginner Scenario (φ_0): illustrating instantiation of [M]. Source: Own elaboration.

In turn, the effects of [E] upon [M] are exemplified in **Figure 4.18**. For instance, some *lack of cohesion of the team*, can be a consequence of the mentioned disturbing effects of environment [E] (arrows 1, 2 and 3 in **Figure 4.18**). This kind of refractory behavior can restrain the teamwork performance. We can classify this kind of effect as "*organizational culture*" influence, when the team culture is not prepared in advance to face this kind of disturbances [E].

Furthermore, team can face conditions where the technology (e.g., *software language*, *acquired device/hardware*, *software component from a supplier*, etc.) chosen by the organization (or customer) to develop the new software product (P1) might not be mature enough (e.g., *recently launched technology*), or not be the team members specialty. As consequence, the *deficiency of expertise* (*experience* or *qualification*) on that technology can limit or retard the teamwork advance, delaying the project schedule. We can name these effects as a mix of "*technological impact*" [E] and "*people qualification*" [M] (arrow 4 in **Figure 4.18**).

Other preponderant influence that could cause significant limiting effects on teamwork performance might be illustrated by the "*absence of leadership*", originated by a team composed by inexperienced members where not emerged a natural leader, or a novice manager, *vested recently* by senior management, who have not yet earned the *respect and cooperation of the team*.

Regarding to the leadership factor effect, there is also other kind of situation where the *senior management or the owner* (for small companies or family businesses) *exert a harmful influence to the team*, *changing priorities very often* or keeping the team under an *oppressive charging*. In this latter case, we can consider this behavior more an occurrence of environmental factor [E] than a moderator factor [M], because the "*inadequacy of leadership*" is caused by factors outside the teamwork context (top management) (arrow 5 in **Figure 4.18**). As a negative strengthening cycle, low team morale influences the members' attitude, hindering the development of new competencies, because it affects the attitude of team members (arrow 6 in **Figure 4.18**).

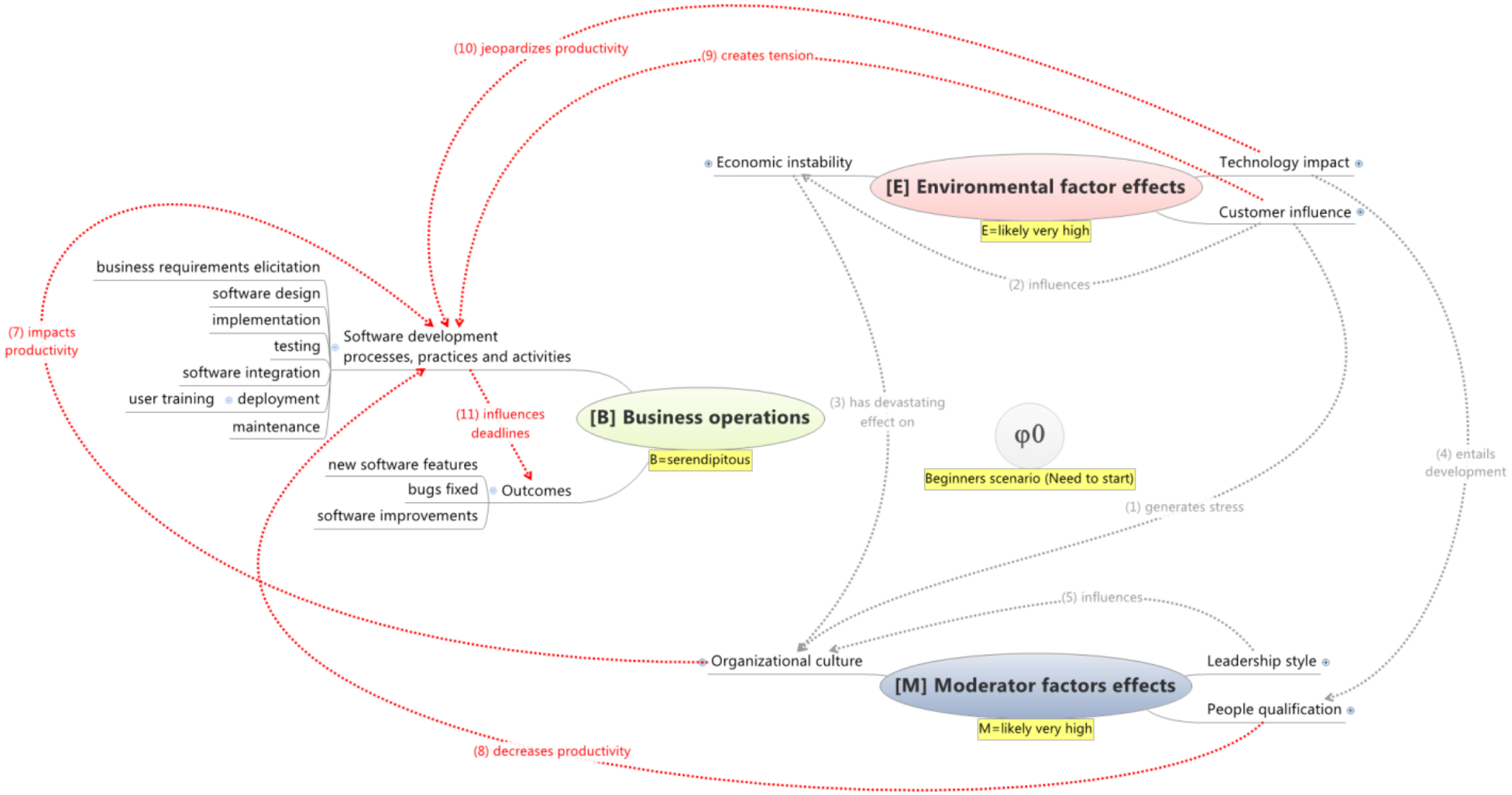


Figure 4.19 – Beginner Scenario (φ_0): illustrating instantiation of [B]. Source: Own elaboration.

Considering that we are describing a software development team experience, we can identify as **business operations [B]** from this organizational context a set of processes, practices and project activities related to the core business: produce and maintain software. In short, in the context explored by this theory instantiation, the business operations [B] related to teamwork context, are referring to processes, practices and activities related to: *business requirements elicitation* and analysis, *software design*, *implementation*, *testing*, *software integration*, *deployment* and *maintenance*. **Figure 4.19** depicts examples of influences from [E] and [M] upon [B].

To recap, all these business operations [B] are under the combined influence of the effects from external environment [E] and moderator factors [M] from the inner teamwork context, as depicted in **Figure 4.16**. Those effects from [E] and [M], in some manner, reduce the performance of the business operations [B], in a way that whether those harmful effects were null [i.e., E=0 and M=0] the business operations [B] performance would be better than when the effects of [E] and [M] are present. In other words, whether the team members were not feeling threatened by the "*economic instability*" caused by the delay of wages ([E] effect), the team morale would not be shaken; neither jeopardize the teamwork cohesion (arrow 3 in **Figure 4.19**). Thus, with a less refractoriness "*organizational culture*" ([M] effect), the implementation [B] of the features bargained with the customer for an established deadline would be successfully fulfilled, or at least, there would be fewer obstacles to compliance (arrow 7 in **Figure 4.19**). At the same time, the "technological impact" derivative of the choice an immature technology, while entails development of "team qualification" (arrow 4 in **Figure 4.19**), it jeopardizes the productivity of the team to handle with this novice technology (arrow 10 in **Figure 4.19**), decreasing team productivity while the need competencies were not completely developed (arrow 8 in **Figure 4.19**). In addition, the time pressure to deliver software features from "customer influence" creates tension in software development activities [B] (arrow 9 in **Figure 4.19**), what with all these factors compromises the software development outcomes (arrow 9 in **Figure 4.19**).

At this point it is important to clarify that the mission of the teamwork context is not accomplished, yet. The organizational mission does not finish when the business operations [B] deliver products or services, e.g., software features.

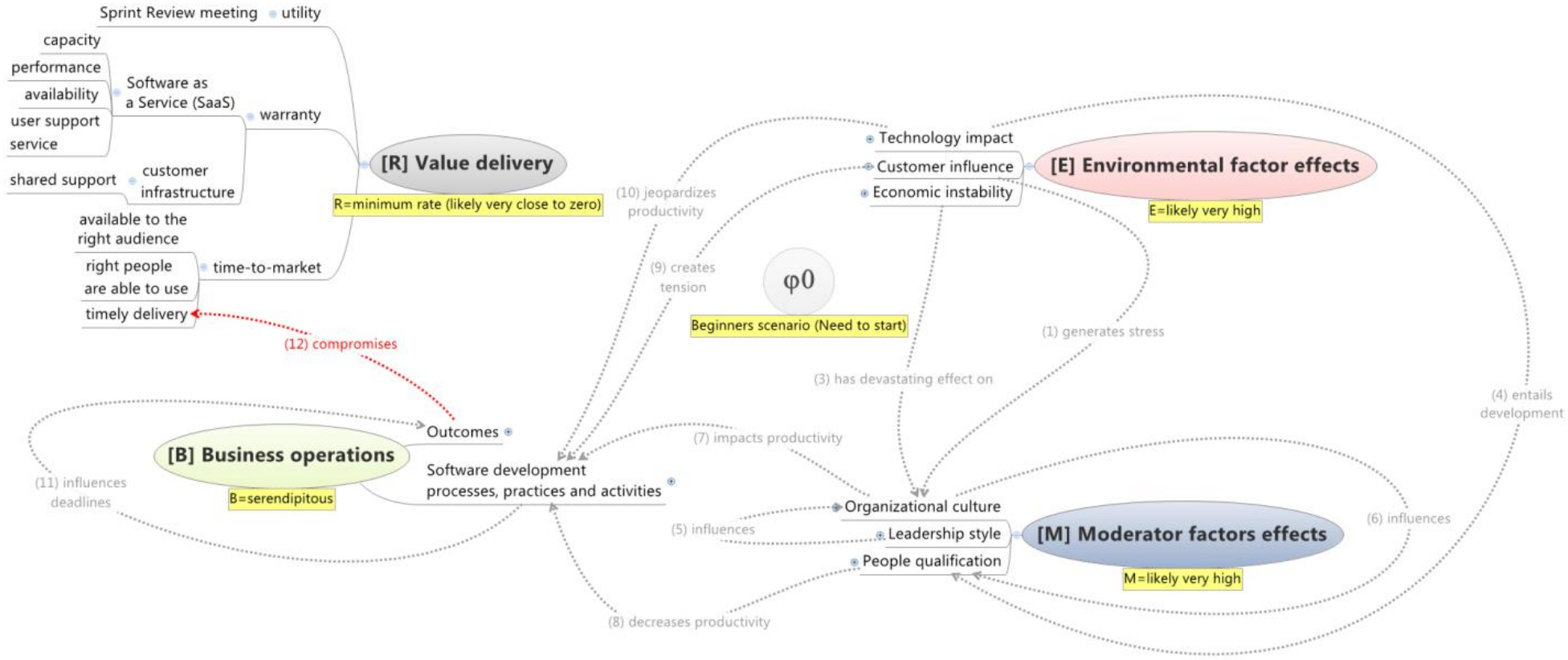


Figure 4.20 – Beginner Scenario (φ_0): illustrating instantiation of [R]. Source: Own elaboration.

In fact, after business operations [B] have provided their outcomes, it is indispensable assuring the **value delivery [R]** of these outcomes to the audience, which behaviorism is described by the **Law 6**, detailed in Section **4.3.2.6**. The value delivery [R] is related to three dimensions: (i) **utility**: whether the outcomes are fit for purpose; (ii) **warranty**: whether they are fit for use; (iii) **time-to-market**: whether they are available at the right time, in the right place, to the right people. For instance, it is not enough develop new software features and demonstrate them to customer representative by means of a *Sprint Review meeting*.

In these meetings the customer representative should verify with the team whether the functionalities required were done as requested. Hence, this kind of ceremony only addresses the first dimension: *utility*. In turn, to deliver real value, those software features should be available for use. The dimension *warranty* depends on the business model of the organizational context, or the project requirements. For example, if the *software should be delivered as a service (SaaS)*, the warranty dimension must assure: the *software capacity to support the projected demand* (i.e., number of concurrent access users specified for the service design), the planned *performance* (i.e., response time for the operations performed by the software), its *availability* (i.e., the daily time window in which it must operate), *user support service*, etc.

On the other hand, whether the project requirements demanded that the software must be installed inside the *customer infrastructure*, the warranty accountability should be shared with the customer IT team. In that case, this dimension would not be addressed until the software is available for use on that infrastructure. However, even whether those software features were done as requested (*utility*), and they are available for use (*warranty*), but the right people are not capable to use them (e.g., because they were not trained to do that), or there is any other impediment that can derail their full use, the value was not properly delivered [R]. For instance, whether the software features become *available for use too late to be useful*, due the business demand that has originated them no longer exists. Hence, all those previously mentioned influences on [B] can compromise the value delivery in time (arrow 12 in **Figure 4.20**). These aspects are related to third dimension: *time-to-market*. In other words, the effort of the team to generate value, has no meaning whether it fails to deliver value to those who really need it. In addition, teams should include in their planning the activities to assure value delivering to the audience.

At this level of theory application we can infer that the effects of [E] and [M] are likely very high, as well as the capability of the team, to handle with them, is likely very low, due [A] and [G] have null values. As a consequence, business operations [B] are under full influence of the disturbing effects from [E] and of the limiting effects from [M], hindering its performance [B], causing serendipitous values for [B], which in turn compromises the value delivery [R], having minimum rate (likely very close to zero). We can assume (φ_0) as the worst scenario experienced by the team.

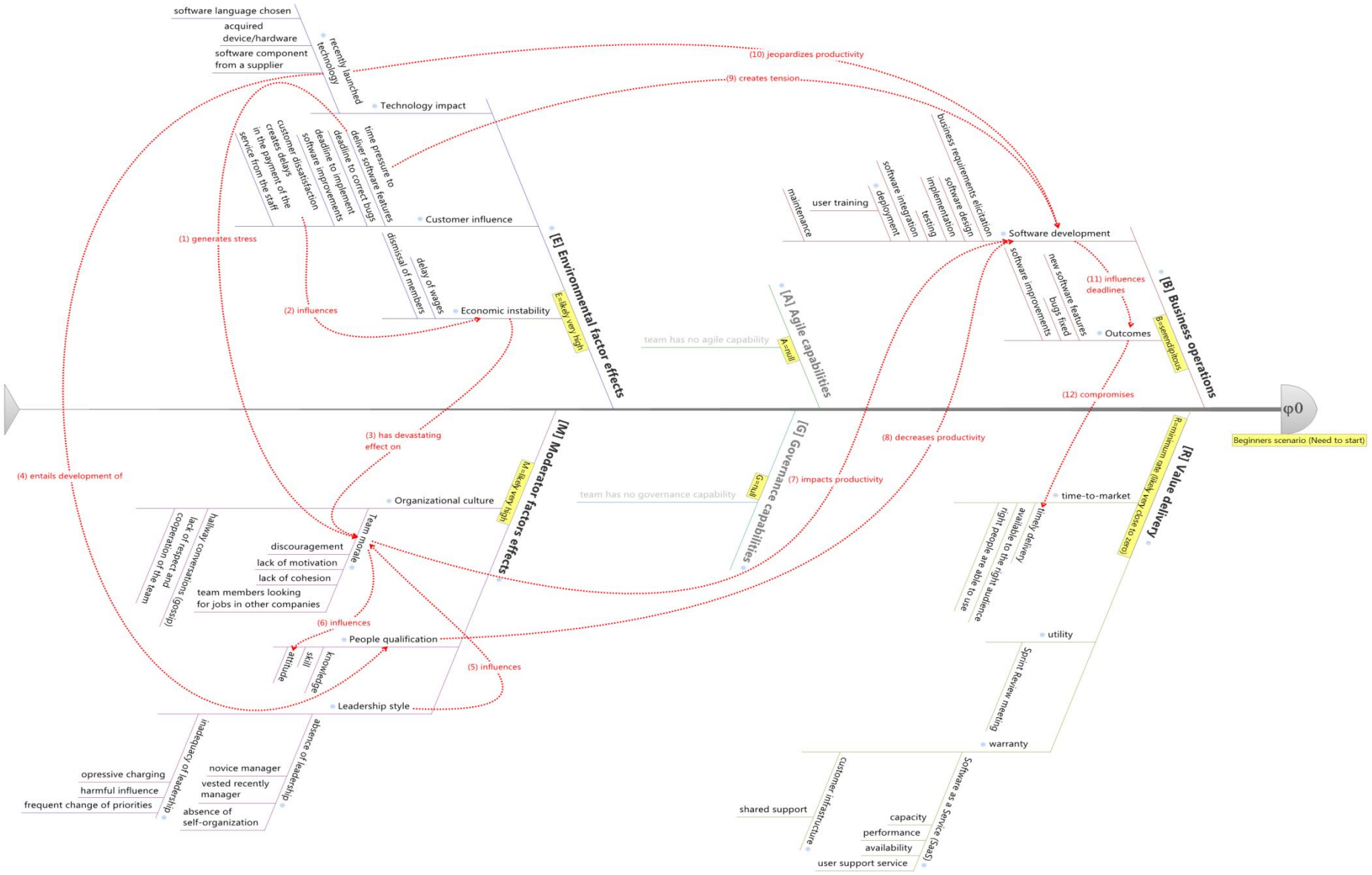


Figure 4.21 – Beginner Scenario (φ_0): illustrating instantiation of the big picture. Source: Own elaboration.

By means of an adapted fishbone chart (Ishikawa and Loftus, 1992) representation, **Figure 4.21** summarizes the instances of the factors that would influence behavior of the constructs (theory units), its values and cause-effect relationships, as well as materializes the "big picture" of the theory demonstration for **scenario (φ_0)**.

4.5.3.2 Governance Scenario (φ_1) and Agile or Lean culture Scenario (φ_2)

In the course of time the team can develop governance capabilities [G] as depicted in scenario (φ_1), or agile capabilities [A] as depicted in scenario (φ_2): both portrayed in **Figure 4.22**.

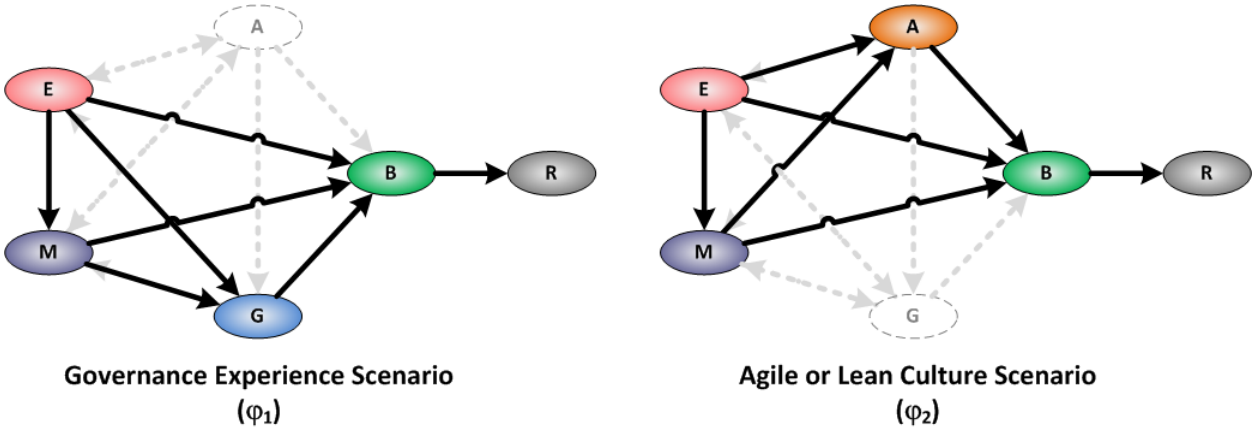


Figure 4.22 – Governance experience Scenario (φ_1) and Agile or Lean culture Scenario (φ_2). Source: Own elaboration.

Indeed, we found many examples of these two scenarios in the findings of our systematic review, when we have characterized the agile governance phenomena and their major trends in Section 3.7.10. As result, **scenario (φ_1)** is related to the **Trend 2** of the **Figure 3.11**, and represents organizational context that have developed some governance experience, considering that governance capabilities [G] can put business operations [B] under control, but at a cost to make it very bureaucratic. They seek simplify and develop business agility without loose the steering capability. On the other hand, **scenario (φ_2)** is related to the **Trend 1** of the **Figure 3.11**, representing organizational contexts that have developed some agile or lean culture, and they consider that agile capabilities [A] can boost the business operations [B], but they feel that agility without steering capability might be dangerous. As a consequence, they seek assure that business operations [B] must be under control, without losing the benefits brought by agile capabilities.

At the same time, these **scenarios (φ_1 and φ_2)**, are described, respectively, as the following macro-system states pre theory depicted in **Figure 4.10** and **Table 4.12**: "Need for speed" (MS3) and "Need for control" (MS2).

In both **scenarios (φ_1 and φ_2)**, we can imply that the effects of [E] and [M] are likely very high on the organizational context. Their effects even influence governance capabilities [G] in **scenario (φ_1)** and agile capabilities [A] in **scenario (φ_2)**, hindering the application of their full potential upon business operations [B], becoming their performance likely very low.

As a consequence, business operations [B] are under high influence of the disturbing effects from [E] and of the limiting effects from [M], hindering its performance [B], which in turn compromise the value delivery [R].

During **scenario (φ_1)**, **governance capabilities [G]** begins to emerge supported by three dimensions: (i) **strategic alignment**: "the analytical ability to define and prioritize what is crucial to do"; (ii) **steering ability**: "the course keeping ability and the maneuverability"; and, (iii) **control**: "the assuring ability of the strategic accomplishment". **Figure 4.23** depicts these dimensions.

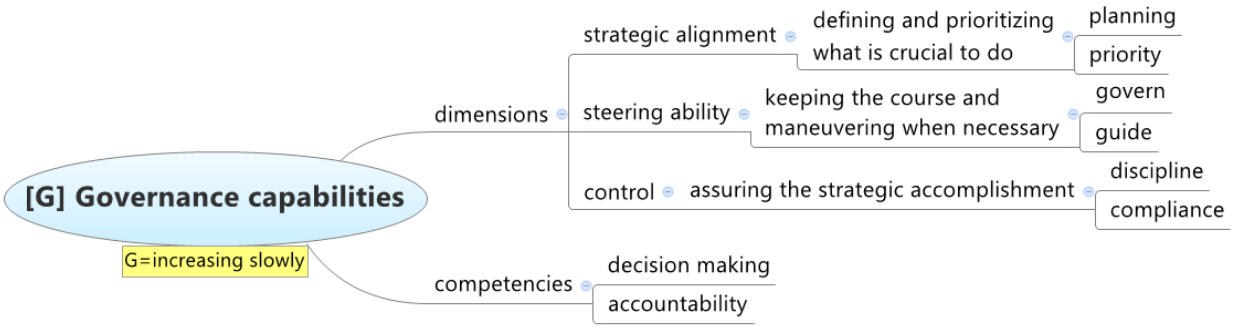


Figure 4.23 – Need for speed (φ_1): illustrating instantiation of [G]. Source: Own elaboration.

All along **scenario (φ_2)**, **agile capabilities [A]** begins to arise sustained by three dimensions: (i) **sensing ability**: "the instinctive ability to sense and react coordinately"; (ii) **positive attitude**: "the mindset to create favorable conditions to reach positive outcomes"; and, (iii) **readiness**: "the ability to be ready, willing, and able for action". These dimensions are portrayed in **Figure 4.24**.

Whether on one hand in **scenario (φ_1)** governance capabilities [G] can assign some *steering ability*, *control* and *strategic alignment* upon business operations [B], or in **scenario (φ_2)** agile capabilities can allow some *sensing ability*, *readiness* and *agility* on business operations [B]:

increasing their outcomes and consequently the potential of the value that can be delivered [R] by these outcomes, whether compared with the values of the related variables on previously discussed **scenario (φ_0)**. On the other hand, in both **scenarios (φ_1 and φ_2)** the contribution of, respectively, [G] and [A] is limited, because they do not react against the effects from [E] and [M].

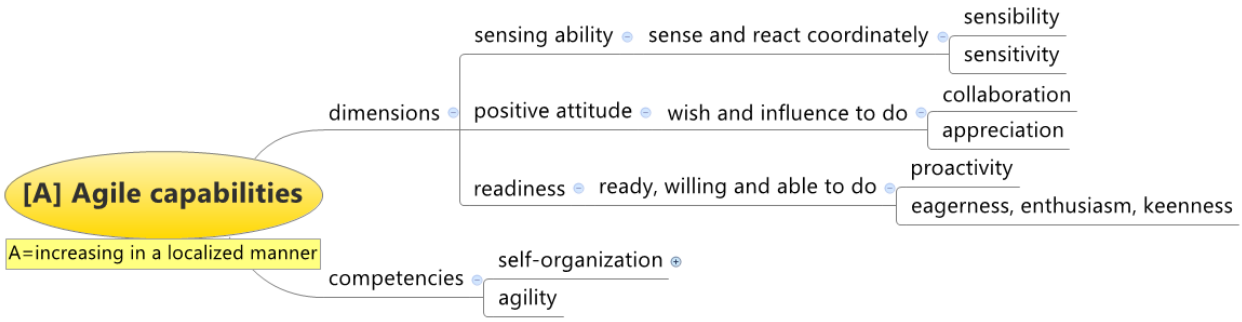


Figure 4.24 – Need for control (φ_2): illustrating instantiation of [A]. Source: Own elaboration.

As an example, we can mention the "customer influence" [E] that affects the level of refractoriness of the "organizational culture" [M] when influence the "teamwork cohesion" [M] (arrow 1 in **Figure 4.19**). These factors affect the team "self-organization", an agile capability [A] in formation, which can empower the "ability to select voluntarily the work to be done" (implementation of stories or maintenance tickets) [B] available on the backlog of the project iteration in progress. However, the "self-organization" [A] applied on its pure form cannot reduce the influence caused by the effects of [E] and [M]. We will explore in deep this example when we discuss the **scenario (φ_5)** in Section 4.5.3.5.

In the prior **scenario (φ_1)**, we can infer that [G] cannot do its effect become deft enough to generate quick consequences on [E] and [M], due the absence of [A]. On the other hand, in the later **scenario (φ_2)**, we can infer that [A] cannot do its influence become properly permanent to generate consistent consequences on [E] and [M], due the absence of [G]. In other words, there is no effectiveness when we have speed [A] without control [G], much less efficacy when we have power [G] without agility [A]. Thus, this lack of effectiveness, of [A] or [G] working alone, limits their responsiveness, respectively, on each scenario.

At this level of theory application we can infer that the effects of [E] and [M] remain likely high, as well as the capability of the team, to handle with them, is likely low, due [G] and [A] have increasing values (but very low), and they are acting separately and alone, respectively, in **scenario (φ_1 and φ_2)**. As a consequence, business operations [B] are still under full influence of

the disturbing effects from [E] and of the limiting effects from [M], hindering its performance [B], causing serendipitous values for [B], which in turn compromises the value delivery [R], having low rate.

4.5.3.3 Dissociative Scenario (φ_3)

As an evolution of the previous scenarios, we can realize the **scenario (φ_3)** as being a mix of the **scenarios (φ_1 and φ_2)**, where there are both significant presences of governance experience and agile/lean culture, which may be an indication that there are latent agile and governance capabilities on the organizational context, but these capabilities are not working together to fulfil the teamwork context goals. **Figure 4.25** depicts this scenario.

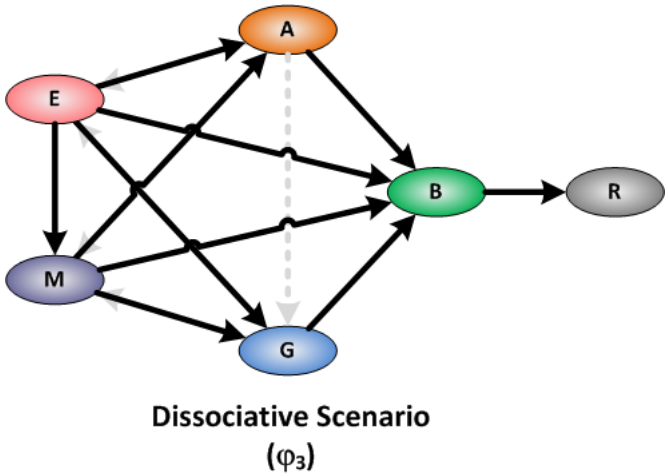


Figure 4.25 – Dissociative Scenario (φ_3). Source: Own elaboration.

Nevertheless this seem odd, this scenario is experienced by many organizations in several conditions. We would cite context where the organization has already have many years developing agile approach, in fact, generating some positive effect upon business operation, but in a specific area of the enterprise *value chain*[61], such as software development or manufacturing. Meanwhile, the organization begins to adopt some governance processes, by its own initiative, or by the pressure of its customers, or due regulatory issues from the market where it operates. They even can achieve *business agility*, on the specific value chain link where they are developing the specific agile approach, but they cannot use these two capabilities in a combined and coordinated manner to improve the value delivery. For that reason the linkage

[61] We are addressing the value chain concept proposed by Porter (1985), which analysis looks at every step a business goes through, from raw materials to the eventual end-user. The goal is to deliver maximum value for the lesser possible total cost.

between agile capabilities [A] and governance capabilities [G] is represented by a dashed gray arrow in **Figure 4.25**.

Furthermore, *business agility* (S2) is a micro-system state of the theory described at Section 4.3.4, which in the case of this **scenario (φ_3)** happens as described by the **Law 2**, as a specific and localized agile approach, which in turn is detailed in Section **4.3.2.2**.

This situation was truly reported by the *Subject 7*, an experienced Software Engineering who works in a large IT services company, providing services to the Brazilian government, during the interview, when he told us: "*We have many years working with agile methods specifically in the context of our software development teams... Four years ago we have started to implement IT governance processes to assure the quality and continuity of IT services provided for our customers... We, actually, have had success, but there is a gap between our teams of software development and IT service operation. We feel that something is missing! This conversation is being timely, because only now we are trying to bring some principles, values and practices from agile software development to our governance processes..."* [IT07, 199:211-223].

For instance, considering we are describing the application of theory on a software development team, at this **scenario (φ_3)**, it would mean that the team has already developed an agile culture exclusively addressing the agile software development [A], and simplifying business operation [B] approach (arrow 13 in **Figure 4.26**). At the same time, the top management has already implemented a set of governance processes [G] to guarantee the project delivery by means of monitoring meetings and to control costs (arrow 14 in **Figure 4.26**). However, these [A] and [G] capabilities are not being combined on software development [B] in favor of value delivery [R]. We can imply a slight improvement in the value delivery rate of this **scenario (φ_3)**, when we compare with previous ones, due the independent influence of [A] and [G] upon [B], but it is not enough significant.

This **scenario (φ_3)** is depicted in **Figure 4.10** and **Table 4.12**, as the following macro-system state pre theory: "*Need for compass*" (MS4). This name amusingly denotes that team members have the essential resources to develop the *trail*, but they do not know how to find the path to the treasure. Namely, the team members need some guidance (compass) to do that. Other picturesque analogy would be that team members have the essential components to make the *dish* (to cook), but they do not know how to combine them to get the best possible result.

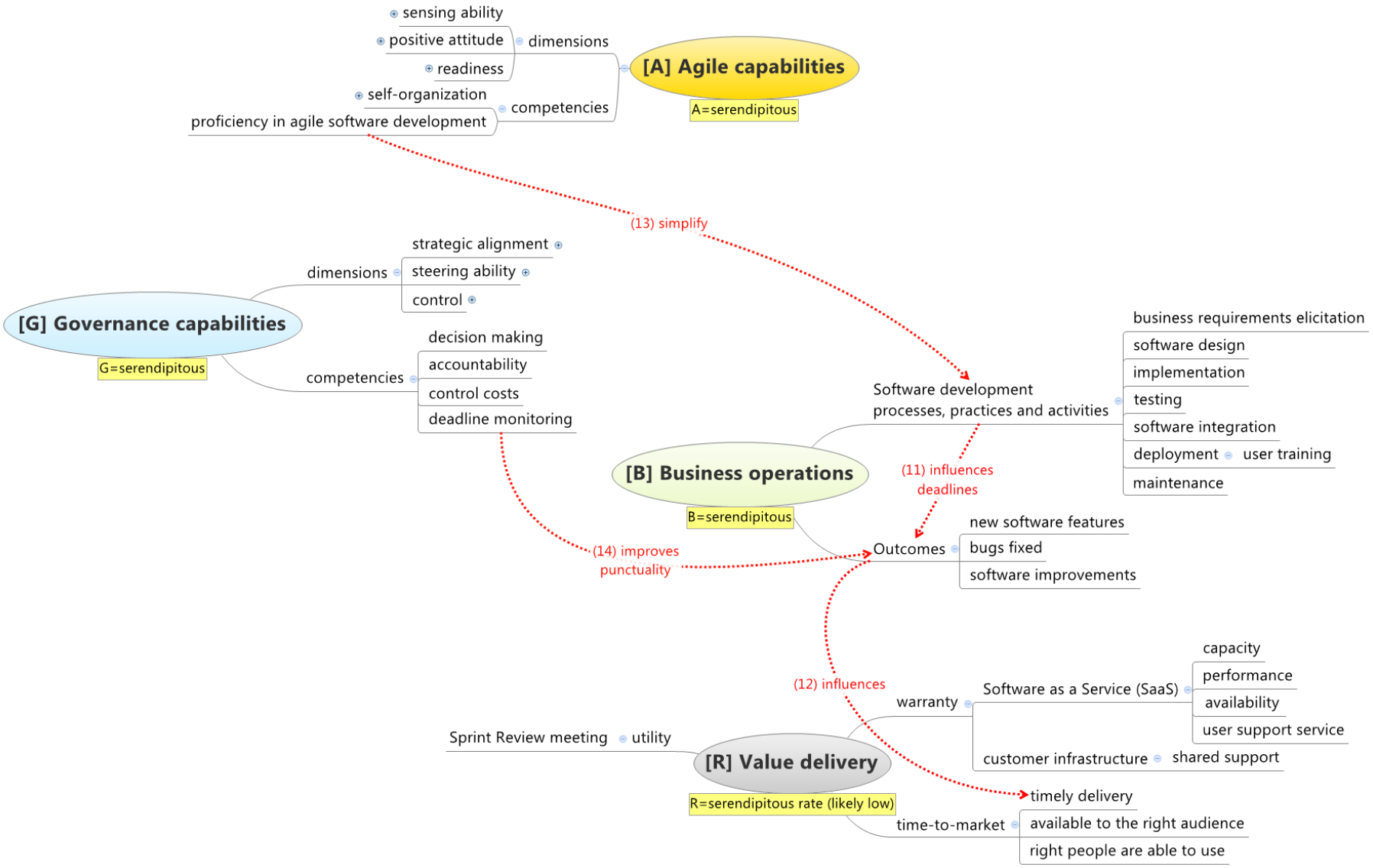


Figure 4.26 – Dissociative Scenario (φ_3): illustrating instantiation of [A] and [G]. Source: Own elaboration.

In other words, there are agile capabilities and governance capabilities, but there is not agile governance capability to engage all value chain links to work in a combined and coordinated way, to empower the business operations [B] in order to reach maximum business agility and generate highest ratio of value delivery.

At this level of theory application we can infer that the effects of [E] and [M] are still likely high, as well as the capability of the team, to handle with them, is limited, due [G] and [A] have serendipitous values (likely low). Despite the presence of both [A] and [G] in **scenario (φ_3)**, they are still acting independently. As a consequence, business operations [B] are still under influence of the disturbing effects from [E] and of the limiting effects from [M], hindering its performance [B], causing serendipitous values for [B], which in turn compromises the value delivery [R], having serendipitous rate (likely low).

4.5.3.4 Startup Scenario (φ_4)

At this theoretical **scenario (φ_4)**, almost all laws of interaction from theory are present, in their full setting. The exception is made to the Law 5, which manifests itself only in **scenario (φ_5)** as a temporal consequence of the Law 1. All those laws of interaction were discussed in deep in Section **4.3.2**.

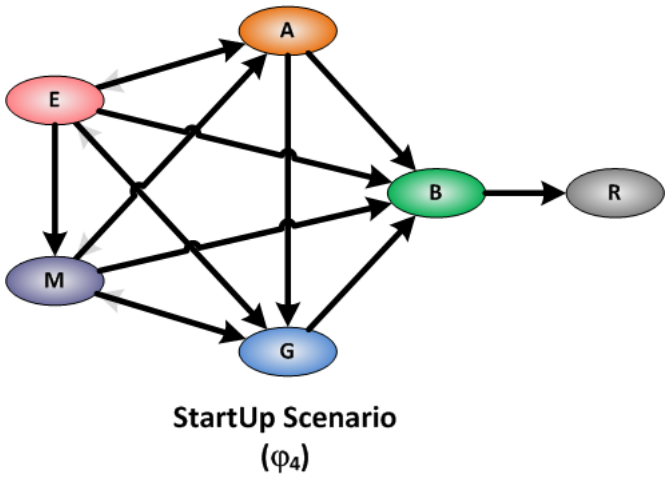


Figure 4.27 – Startup Scenario (φ_4). Source: Own elaboration.

We can say that the complete use of the theory start at this scenario, as a consequence of the first law, when ***agile governance*** emerges by the coordinated combination of agile [A] and governance capabilities, working together upon business operations [B] to reach the best value delivery [R] rate to the system described by this theory. It is for this reason that **scenario (φ_4)**

was named as “startup”. Note that the significant difference between **scenario (φ_3)** and **scenario (φ_4)**, by means of the comparison between **Figure 4.25** and **Figure 4.27**, is the behavior described by the first law, which is represented by a black arrow linking [A] and [G].

As a consequence, the dimensions of [A] and [G] start to be combined to develop competencies to empower business operations [B], and, at a second stage in **scenario (φ_5)**, combat the effects of [E] and [M]. As a result, it is expected that the value delivery [R] increases progressively.

Figure 4.28 depicts an exemplification of how the dimensions of [A] and [G] would be combined to this order. For instance, the *sensing ability* from [A] can empower the *steering ability* from [G], developing the *ability to perceive and react coordinately on time*, to changes (arrow 15 in **Figure 4.28**).

Either, the *readiness* dimension [A] can be combined to the *strategic alignment* [G], developing the *ability to keep teamwork strategically aligned with the business goals*, and developing the team mindset to be ready, willing and able to do what is needed achieve strategic objectives, and seeking associating each routine activity with the overall strategy (arrow 16 in **Figure 4.28**). Or even, when the positive attitude [A] of the team can become the control [G] activities less oppressive, by means of the developing of the ability to self-control, collaboration and appreciative influence to do, helping to engage team members (arrows 17, 18 and 19 in **Figure 4.28**). As a consequence, the *deadline monitoring* can improve the punctuality of the deliveries from software development process (*outcomes*), which in turn reduces the time to deliver software features at right time to the business demands (*timely delivery*) (arrows 14, 12 in **Figure 4.28**).

At this level of theory application we can imply that the effects of [E] and [M] are likely high, as well as the capability of the team, to handle with them, begins to improve, due [G] and [A] have increasing values (likely low). However, due combined and coordinated working of both [A] and [G] the organizational context breaks the initial inertia, directing to gain momentum thereafter. As a consequence, business operations [B] are still under influence of the disturbing effects from [E] and of the limiting effects from [M], hindering its performance [B], but increasing values for [B] can already be perceived (by means of the effects from joint working of [A] and [B]), which in turn enhance the value delivery [R], having increasing rate (still likely low).

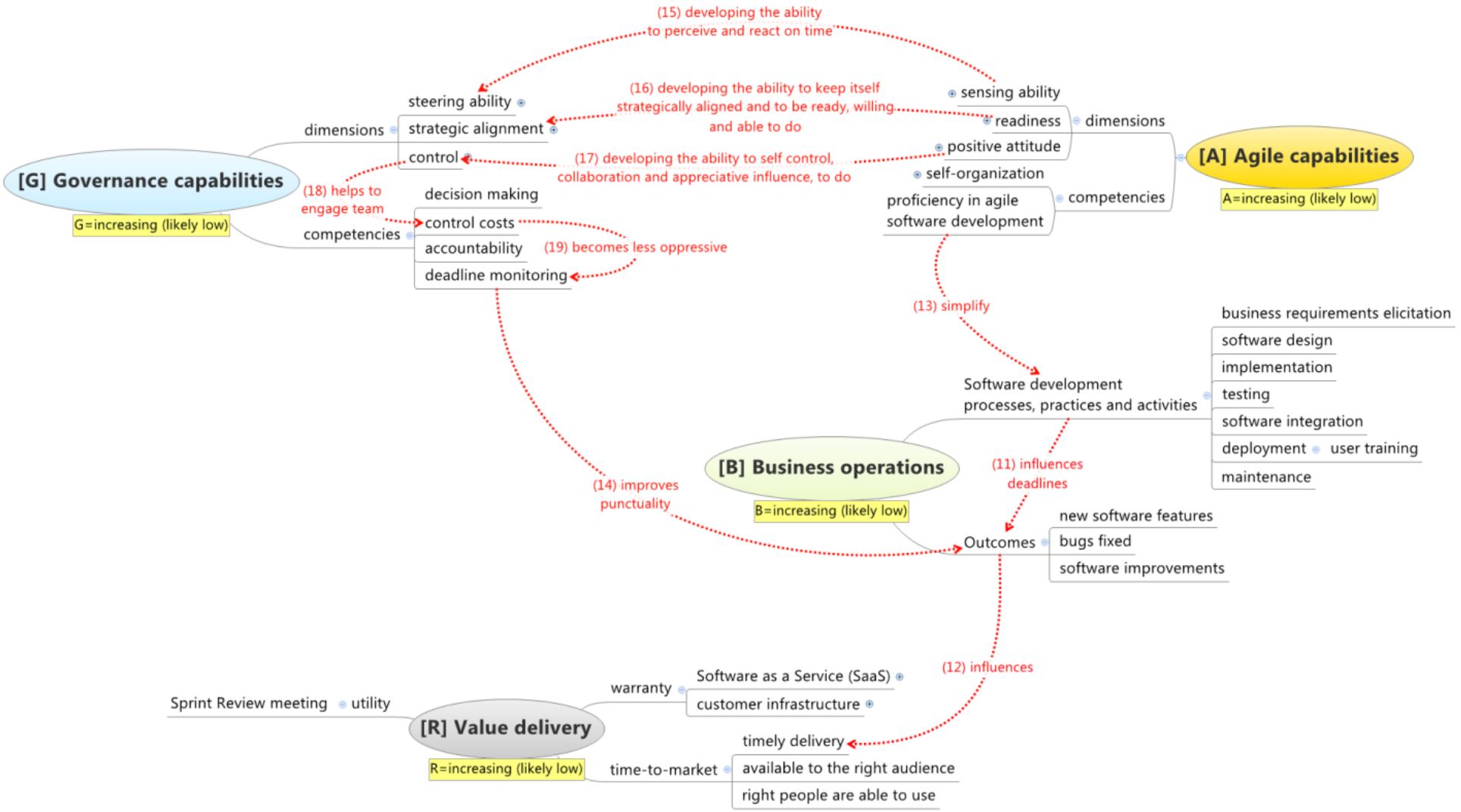


Figure 4.28 – Startup Scenario (φ_4): illustrating instantiation of [A] and [G] and consequence of first law. Source: Own elaboration.

4.5.3.5 Countermeasure Scenario (φ_5)

The countermeasure **scenario (φ_5)** is reached by the organizational context, as a consequence of the joint work of [A] and [G], started at the **scenario (φ_4)**. **Figure 4.29** depicts the **scenario (φ_5)**, which allow us see the double arrows in opposite directions linking [A] and [G] to [E] and [M]. From each arrows pair, the black arrows represent the combined reaction of [A] and [G] against the effects of [E] and [M], while the gray dashed arrows from [E] and [M] symbolize the remaining decreasing effects from those constructs, after the cooperative response from [A] and [G].

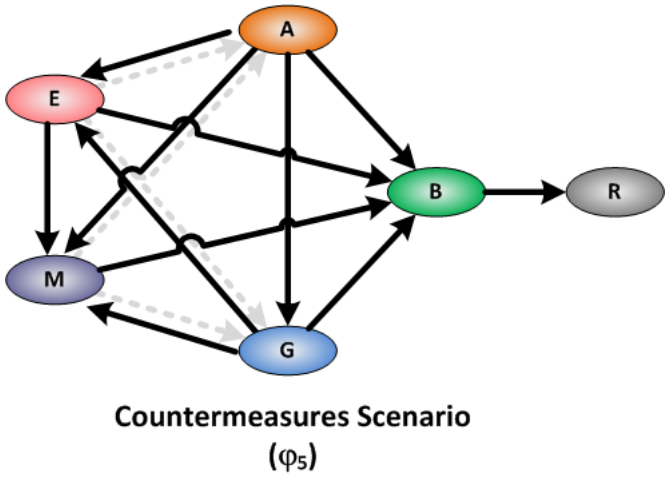


Figure 4.29 – Countermeasure Scenario (φ_5). Source: Own elaboration.

The countermeasure behavior is explained by the Law 5, discussed in detail in Section **4.3.2**. As a matter of clarity, the effects of Law 5 in **scenario (φ_5)** can be decomposed in two theoretical sub-scenarios: (i) Sustainability scenario **($\varphi_{5'}$)**; and, (ii) Competitiveness scenario **($\varphi_{5''}$)**; both depicted in **Figure 4.30**.

In the **Sustainability scenario ($\varphi_{5'}$)** agile capabilities [A] and governance capabilities [G] interact to reduce the effects of moderator factors [M] in the organizational context. The black arrows from [A] and [G] to [M] illustrate this demeanor, while the dashed gray arrows in opposite direction, represent the remaining attenuated effects from [M] upon [A] and [G]. Note that, as a consequence the black arrow from [M] to [B] appears dashed, characterizing the decreasing effect from [M] upon [B], after the combined and coordinated action of [A] and [G] upon [M].

In turn, during the **Competitiveness scenario ($\varphi_{5''}$)** agile [A] and governance capabilities [G] collaborate to decrease the effects from environmental factors [E] upon the organizational

context. The black arrows from [A] and [G] to [E] illustrate this comportment, while the dashed gray arrows in contrary direction, indicate the residual mitigated effects from [E] upon [A] and [G]. As a result, the black arrow from [E] to [B] shows up dashed, representing the reduced effect from [E] upon [B], after the combined and coordinated work of [A] and [G] upon [E]. In complement, the consequences of [A] and [G] upon [E] also leads to diminishing of the effects from [E] on [M], which in turn, is depicted by the dashed black arrow that connect these two theory units.

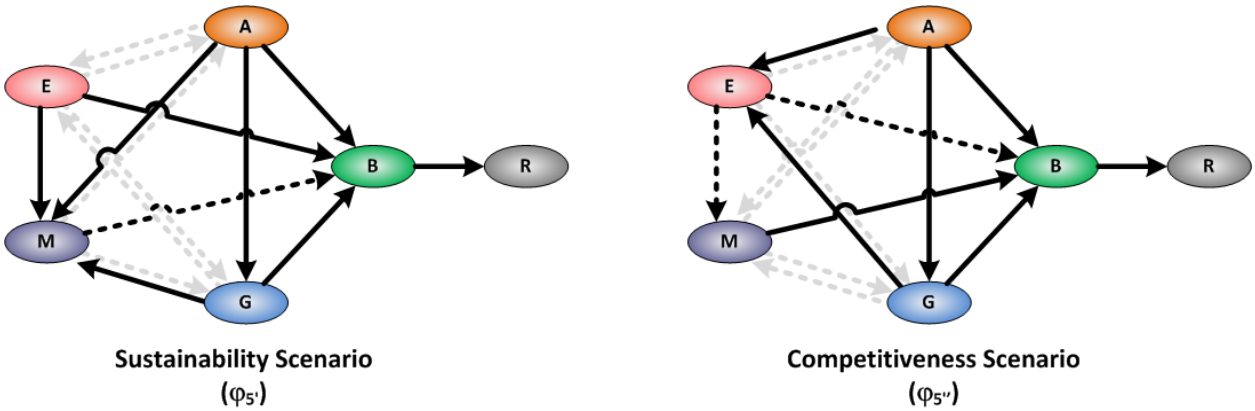


Figure 4.30 – Countermeasure Scenario (φ_5) decomposed: Sustainability Scenario ($\varphi_{5'}$) and Competitiveness Scenario ($\varphi_{5''}$). Source: Own elaboration.

These sub-scenarios were isolated, didactically, just in order to facilitate to the reader understand what happens in the **scenario (φ_5)**. Truly they do not occur separately in real world. In fact, they happen dynamically, almost at the same time, in organizational environment. To illustrate this phenomenon we will resume the discussion started in the presentation of the **scenarios (φ_1)** and **(φ_2)** (see Section 4.5.3.2) about how agile capabilities [A] and governance capabilities [G] in these scenarios cannot reduce the influence caused by the effects of [E] and [M], when they work singly.

We were using the example of "self-organization" [A] to exemplify this singularity, as depicted in **Figure 4.31**. Retaking the reasoning, "self-organization" can achieve better results when combined with "accountability", a governance capability [G]. Indeed, when *metrics about team members' voluntarism* are put on practice (arrow 20 in **Figure 4.31**), as a next step, the team leader (or manager) can *implement a "productivity awards policy"* [G] (arrow 21 in **Figure 4.31**). This policy can *reward those more available and efficient members and encourage other members to do the same, improving team productivity* (arrow 22 in **Figure 4.31**). From the combination of that agile capability [A] and this governance capability [G], arises the "agile governance capability" [AG]: "***self-accountability***", represented by a diamond **Figure 4.31**.

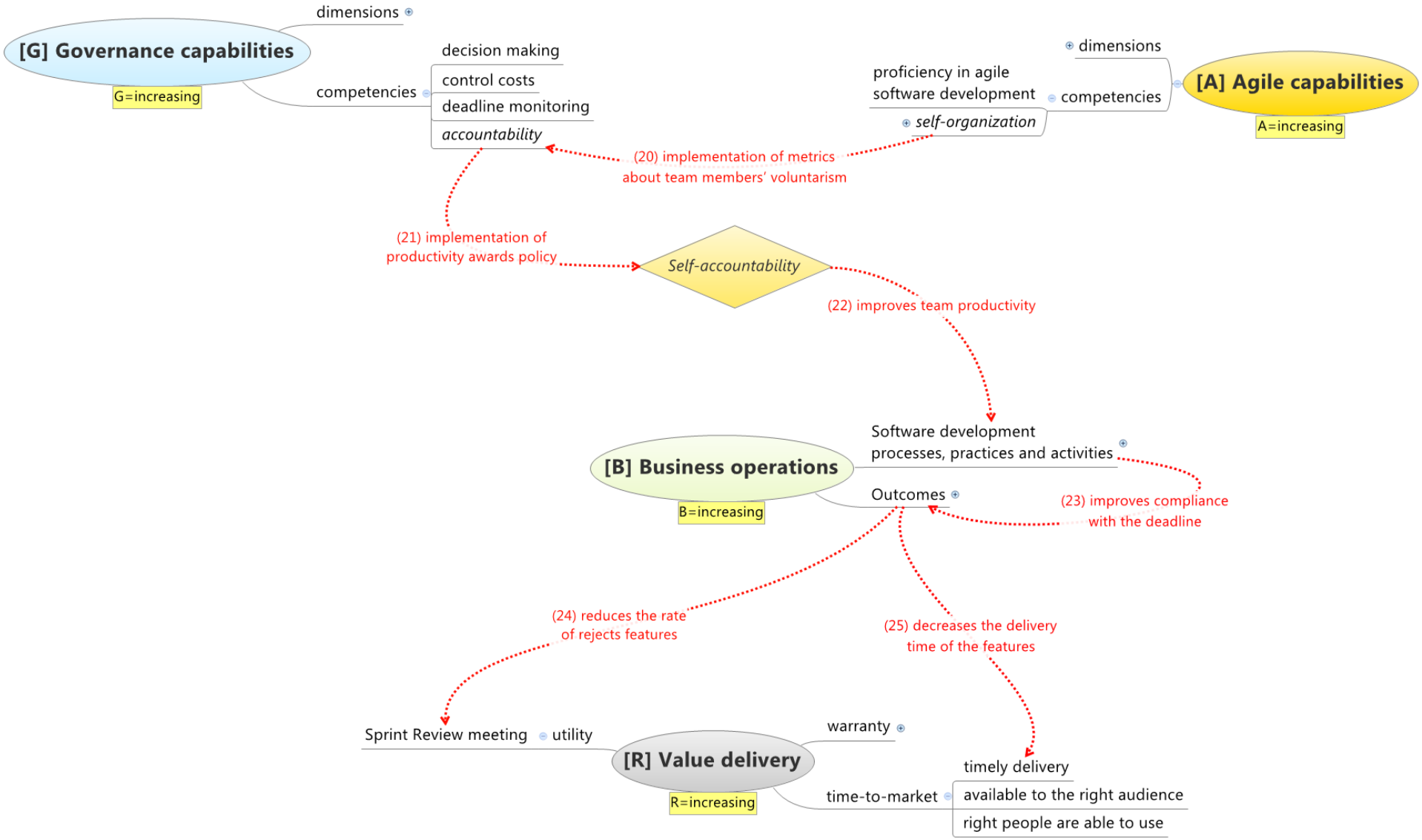


Figure 4.31 – Countermeasure Scenario (φ_5): illustrating instantiation of [AG] capabilities and consequences upon [B] and [R]. Source: Own elaboration.

Indeed, this phenomenon, in varied manifestations, was identified in many experience reports found in our systematic review detailed at Section **3.7**, such as depicted in **Table 4.24**, compiled as a sample of those findings.

Table 4.24 – Evidences of agile governance capabilities: forming phenomenon. Source: Own elaboration.

Who?	Agile capabilities [A]	Governance capabilities [G]	Agile Governance capabilities [AG]	References
4 **U.S.** federal agencies	Agility, flexibility	Policy making	Agile policy-making	Agile Public Administration, [S153] (Parcell & Holden, 2013)
UK police service (5 Case studies)	Lean, self-organization, citizens collaboration	Police service	Lean policing	Agile Public Administration, [S128] (Barton, 2013)
European community (European Directive 42 2001; European Directive 35 2003)	Transparency, collaboration, self-organization	Decision making	Urban participatory decision making for territory planning	Agile Public Administration, [S156] (Monizza et al., 2013)
The **Dutch** Immigration Service	Agility, flexibility	Governance of business processes	Mechanisms to measure agility and flexibility of business process in order to improve performance, enhance precision and reduce costs.	e-Government, [S4] (Gong & Janssen, 2010)
Israeli Air Force	agile teams, lean mechanisms, timely	Accountability, metrics, decision making, follow-up resolution	Governance for agile software projects	Governance for Agile Software Development, [S73] (Talby & Dubinsky, 2009)
U.S. Supply Services (USSS) & US Army	Agility, lean, reflectivity (or ability to internalize learned lessons)	Governance for process of contracts, procurement and supply chain	Agile contracting, agile supply chain	Agile Public Administration, [S148] (Knaggs, Pollard & Wang, 2012)
UK British civil service	Lean	Control, business process improvement	Lean government approach for citizen service, Lean innovative "managerialist" response to government demands	Agile Public Administration, [S93] (Carter et al, 2011).
IBM, Israel	Timely, improvability, reflectivity (or ability to internalize learned lessons)	Accountability, control, policy, decision rights	Agile governance for software process improvement	Software Development Governance, [S136] (Dubinsky & Hazzan , 2012)

Going back to our theory's instantiation example, as a consequence of the successfully application of this hybrid capability on software development [B] *improves compliance with the deadline* (arrow 23 in **Figure 4.31**). In turn, this effect can *reduces the rate of rejects features*, improving the dimension "utility" of the value delivery [R] (arrow 24 in **Figure 4.31**), as well as it can *decreases the delivery time of the features*, enhancing the dimension time-to-market of the value delivery [R] (arrow 25 in **Figure 4.31**).

Consecutively, we can have a more productive and motivated team (arrow 26 in **Figure 4.32**), becoming the "organizational culture" [M] *more appreciative* (arrow 27 in **Figure 4.32**) *and reducing the harmful effect* from this factor upon teamwork context (arrow 28 in **Figure 4.32**). Correspondingly, when the effects of [M] are reduced, the team is *generating a more sustainable and comfortable inner environment*, better prepared for future challenges**.** In complement, we should foresee *delivery deadlines met*, as well as outcomes from software development [B] generating the value expected by the customer [R], as predicted by the **Sustainability scenario ($\varphi_{5'}$)**.

Consequently, the effects of the original adverse "customer dissatisfaction" [E] are diminished (arrow 29 in **Figure 4.32**), as described by the **Competitiveness scenario ($\varphi_{5''}$)**. For instance, the initial "customer influence" [E] might be adjusted for a *more cooperative and respectful relation* (arrow 30 in **Figure 4.32**), e.g., resulting in *regularization of payments related to services provided* (arrow 31 in **Figure 4.32**). This, in turn, would *improve the financial backing of the company* where the team works, reducing the effects of "economic instability" [E], allowing that company can pay wages on time (arrow 32 in **Figure 4.32**). Resultantly, this would further increase the motivation (arrow 33 in **Figure 4.32**) and boosts team productivity [B] (arrow 34 in **Figure 4.32**), rising the "team cohesion" (arrow 35 in **Figure 4.32**), which further elevate the "organizational culture" to a more positive and collaborative threshold (arrow 36 in **Figure 4.32**), reducing the effects of [M] and becoming the teamwork context even more sustainable.

It is important to note that there is a feedback loop between the **Sustainability ($\varphi_{5'}$)** and **Competitiveness ($\varphi_{5''}$)** scenarios. As an illustration, the "quick win" achieved by the team (salaries paid on time) would impulse the team to be more competitive, seeking delivery more and more value to the customer in a virtuous cycle of team development.

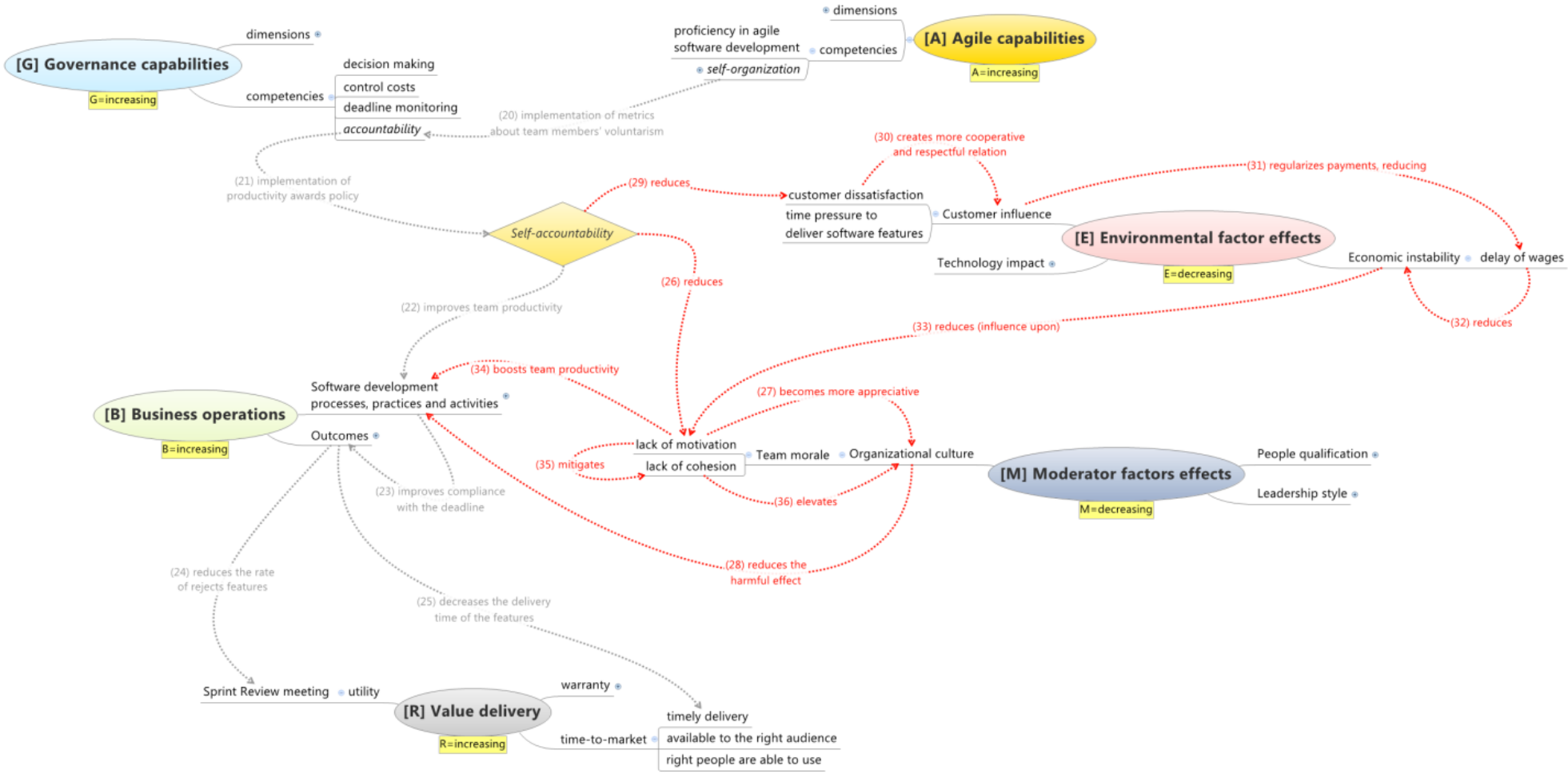


Figure 4.32 – Countermeasure Scenario (φ_5): illustrating instantiation of [AG] capabilities and consequences upon [E] and [M]. Source: Own elaboration.

Please pay attention to the dynamic chain of cause and effect, explained by the theory, which reinforces (and propels) itself every new fact, leveraging and empowering the organizational context: teamwork.

4.5.3.6 Dynamic Scenario (φ_n)

When the organizational context passes through the theory macro-system state **Conscious Agile Governance (MS6)** (see Section **4.3.4.1**), it reaches a good level of organizational sustainability and competitiveness by the application of the theory, reducing much the effects of [E] and [M] and increasing significantly the values of [A], [G], [B] and [R].

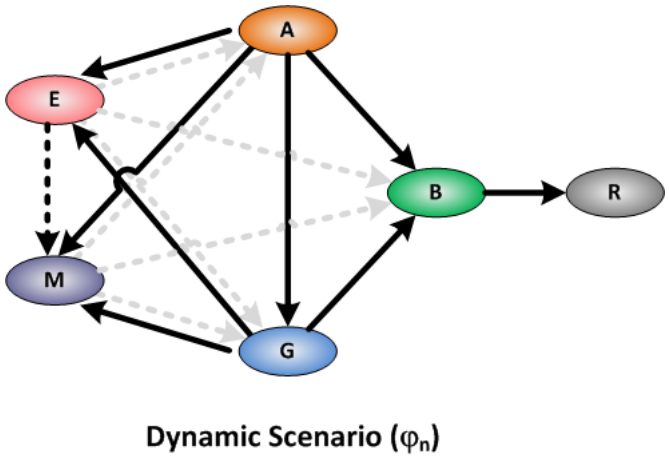


Figure 4.33 – Dynamic Scenario (φ_n). Source: Own elaboration.

As a consequence, we imply that when the organizational context can establish a balance between "sustainability" (S3) and "competitiveness" (S4) micro-system states (see Section 4.3.4) into a **Conscious Agile Governance (MS6)** macro-system state, allowing it to gain equilibrium and responsiveness and maintain that condition persistently (for a time period enough to its institutional internalization), then the organizational context goes into a state of [organizational] "awareness" (S5) , leading the whole system to its maximum performance.

Resultantly, the organizational context starts a new theory macro-system state named **Unconscious Agile Governance (MS7)**. In that system state it reached a high level of organizational sustainability and competitiveness, developing their activities in a high level of awareness, acting and reacting in an unconsciously competent manner, as a coordinated whole, almost intuitively, to deal with the emerging issues from the organizational context and the environment where they are inserted. At this system state [E] and [M] have a minimum effect upon the organizational context, and [A], [G], [B] and [R] have their maximum values. At the **Unconscious Agile Governance (MS7)** state, the system represented by the theory behaves dynamically as depicted in **Figure 4.33**, namely **Dynamic scenario (φ_n)**.

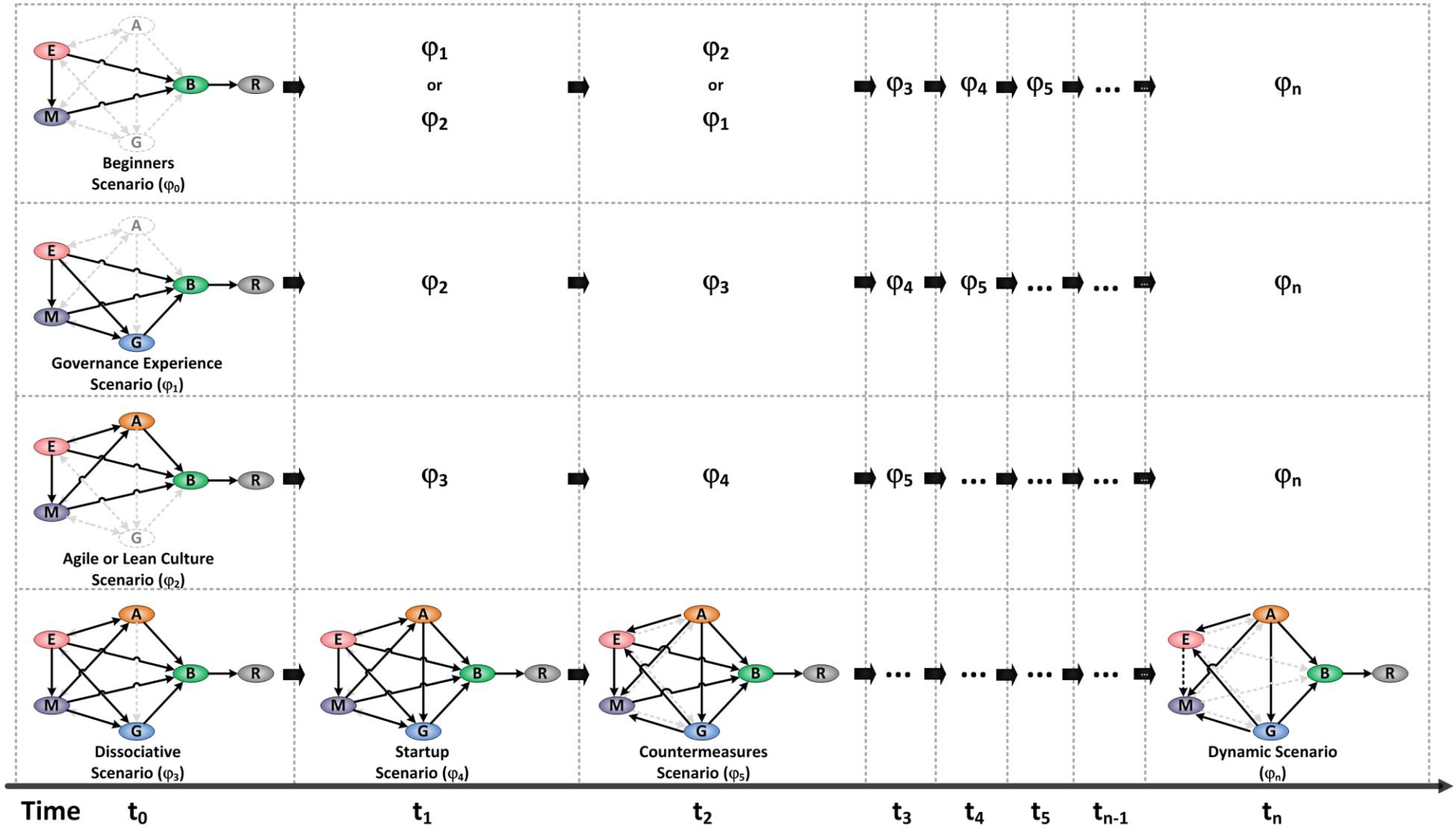


Figure 4.34 – Big picture: the Theoretical Scenarios (φ_1 .. φ_n). Source: Own elaboration.

Despite the representation of the previous theoretical scenarios of the theory has been described as a deterministic sequence of steps, as a matter of clarity, when we consider a discrete time interval, which would be equivalent to consider an infinitesimal timebox, we can realize a quantum behavior of those actions, where those actions not necessarily occur in this sequence, as well as the stages can no longer be distinguished from each other, seeming to occur simultaneously as a function of the environment dynamics. We named this manner of conducting as **theory's quantum behavior**.

We can infer that this quantum behavior should be natural consequence of the high level of awareness achieved by the organizational context (people and organizations) that incorporate deeply the agile governance theory. They can act and react in an unconsciously and able way, almost intuitively, to handle with emerging issues from the organizational context and the environment where they operate.

Figure 4.34 depicts six theoretical scenarios presented and exemplified throughout this Section. They are portrayed in in order of increasing complexity over time in four lanes. These lanes represent, from top to bottom, the four macro-system states pre theory described in Section **4.3.4.1**, namely: i) Beginner (MS1); ii) Agile or lean experience (MS2); iii) Governance experience (MS3); and, iv) Dissociative (MS4).

4.6 THEORY APPLICATION – A theory for action

Despite it being beyond the Dubin's methodology for theory building research, in this Section and in the following subsections, we will propose a set of guidelines on how to put the emerging theory into practice.

4.6.1 The dynamics: theory application lifecycle

As a first step, we will propose a lifecycle for apply the theory, in order allowing an iterative and incremental development of the organizational context in theory assimilation and its effective implementation.

In fact, we have identified two classes of ***influencing factors*** that generate effects upon the scenarios depicted by this theory: i) effects from **disturbing factors** deduced from the nature of

the *external environment* [E]; and, effects from **restraining factors** derived from the *moderators characteristics* [M] of the *organizational context*.

Both classes of influencing factors generate some kind of effect on the steering and performance of the organization. The restraining factors [M] are also affected by the disturbing factors [E], but they do not affect the disturbing ones. In some degree, we imply that the disturbing factors potentiate the restriction effect of the restraining factors, increasing their negative influence on organizational context. Indeed, these interactions were predicted by the Laws 3 and 4, depicted in Section 4.3.2.

The **disturbing factors** [E] might have some positive component on the influence of the organizational context, such as: market opportunities, benefits of a good partnership, and positive influence of regulatory institutions, among others. However, they also may have negative components, such as: market threats, unpredictability, uncertainty, etc. In fact, they effect can be better assimilated insofar as the organizational context become more effective, improving the ***organizational competitiveness***, enabling the enterprise to sense and respond to changes even in a dynamic and challenging environments.

On the other hand, the **restraining factors** [M] are points that deserve attention and should be addressed by the organization to construct a positive, harmonious and effective organizational context. These factors should be worked and improved in order to achieve and maintain a good level of ***organizational sustainability***, becoming the enterprise efficient and resilient, enabling the entire organization to coordinate the overall efforts to generate positive results, work out problems, minimize incidents and collaborate creatively during a long term period, even under external pressures and difficult scenarios.

Based on this rationale, a lifecycle depicted in **Figure 4.35**, emerges from an adaptation of the SWOT Analysis (Humphrey, 2005; Panagiotou, 2003) for theory application. In fact, the proposed lifecycle tries to shed a light on how we can take advantage from understanding the system described by the theory (e.g., from interaction among constructs, how they behave over time, etc.), in order to generate benefits on the steering and performance of the organization.

The **theory lifecycle** is depicted in **Figure 4.35** as an update of the **Figure 4.12**, comprising four stages: (1) External Diagnosis [ED]; (2) Internal Diagnosis [ID]; (3) Organizational Sustainability [OS]; and, (4) Organizational Competitiveness [OC].

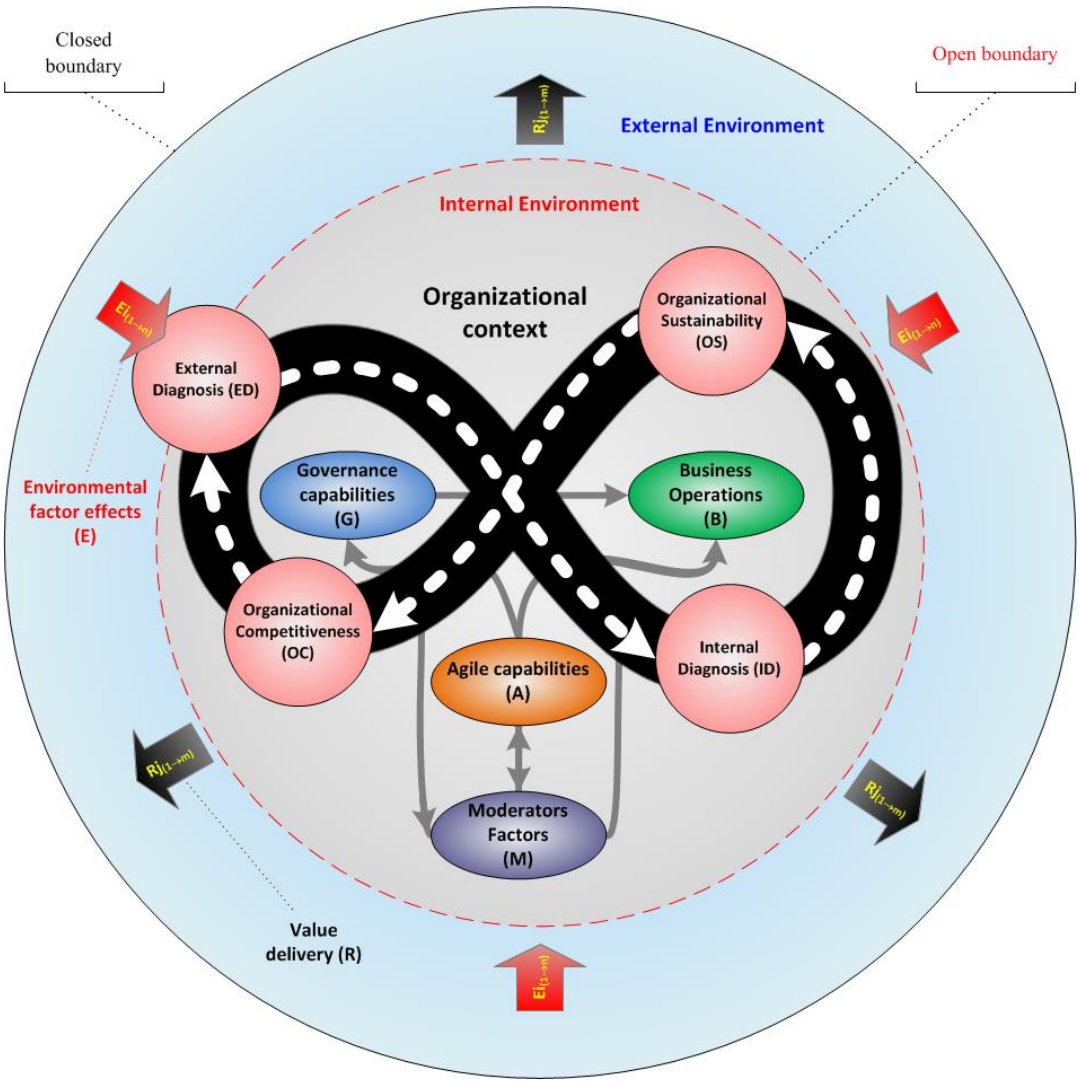


Figure 4.35 – Theory Conceptual Framework updated with Theory Application Lifecycle (masked clown face diagram). Source: Own elaboration.

The constructs of the theory are represented by ellipsoids, the stages of the lifecycle are depicted as spheres, as well as the path of the lifecycle is represented by a big infinity symbol (∞), seeking transmit the idea that these stages are repeated indefinitely. Over the lifecycle path (∞) we can see dotted white arrows that describe the sequence of each stage on lifecycle.

4.6.1.1 External Diagnosis (ED)

The theory lifecycle first stage is the **External Diagnosis (ED)**, when the organizational context analyzes its external environment [E] to identify which are the external factors that can develop a disturbing role for the time increment in question (timebox[62]). For instance, they should identify which external factor can disturbs the current business goals, by means of generating a

[62] We will go further about this concept in Section 4.6.3. For now, the reader should consider a finite period of time related to an iteration of theory application.

threat or a new opportunity. During this stage it is necessary not only identify the factors, as well as measure the level of threats and opportunities that can be generated by them. As a result, the team should obtain a list of disturbing factors, classified by: priority, potential of threat (or potential of opportunity), positive (or negative) potential disturbing impacts, among other relevant attributes to be addressed on the next stages. This set of information will be very important to reduce the effects of moderator factors [M], as well as enable governance capabilities (for coordinating, sense and respond) of the whole organizational context, even to seize fully the emerging opportunities, when appropriate.

4.6.1.2 Internal Diagnosis (ID)

The next stage is the **Internal Diagnosis (ID)**, when we have to investigate which of the moderators factors [M] from the internal environment may be negatively impacted or potentiated by the disturbing factors of the external environment [E], as well as which are the organizational context attributes that can help to reduce or eliminate such effects. In complement, the team involved (on theory application) should carry out an additional analysis about which internal *strengths* can be harnessed (or used as *enablers*) to *minimize* or *mitigate* the *moderator factors* [M]*, as well as* which *weaknesses* must be faced or overcome to enable a sustainable cycle.

We would like to open a parenthesis at this point of this text, in order to clarify the terms adopted to explain the interactions of the constructs, as follows. We are applying the word "*minimize*" on the context of this work, as the ability to treat the root causes of an event in order to minimize or eliminate the probability of its occurrence. That is to say, the event has no happened yet, and we are working to it not occur. Moreover, if we cannot avoid its occurrence, at least we wish that the treatment of its root causes can generate an event with minor impact. In addition, we are using the word "*mitigate*" in the context of this work as the ability to reduce the negative consequences of an event. In other words, the event has already happened and we are treating its consequences, trying to become them less severe, serious or painful. Those strategies should be used in combination as a complementary approach.

At the same time, the team involved (on theory application) must analyze how those organizational attributes can be managed to address imminent threats, or better assimilate the

opportunities, diagnosed at earlier stage. The whole set of those components[63] must be organized, prioritized and have their potential analyzed or estimated, as well as their interaction and impacts mapped in a *fishbone chart* (Ishikawa and Loftus, 1992), such as in **Figure 4.21**, or even in a kind of *tracking network* (see example in **Figure 4.36**) to be addressed on the next stages of the current cycle (iteration). This set of information shall be useful to the next stages in order to become the enterprise more efficient and resilient; enabling the entire organization can coordinate the overall efforts to generate business agility.

4.6.1.3 Organizational Sustainability (OS)

At the third stage, **Organizational Sustainability (OS)**, we should identify which agile capabilities [A] and governance capabilities [G] will be required to address the scenario mapped on the previous stages, in order to perform the following strategies: (1) potentiate the existing strengths; (2) eliminate, minimize or mitigate the moderator factors [M]; (3) overcome the weaknesses that can undermine the organizational context.

As a second step the team must apply the agile capabilities [A] in a combined and coordinated manner with governance capabilities [G] upon internal strengths, allowing to implement the strategy (1), to perform, as a consequence, strategies (2) and (3), as exemplified in **Sustainability scenario ($\varphi_{5'}$)**, detailed in Section 4.5.3.5. As a result, the establishment of a new level of organizational sustainability is expected in order to achieve the goals of the next stage.

4.6.1.4 Organizational competitiveness (OC)

In the fourth stage of the theory lifecycle, we identify (and review) which agile capabilities [A] and governance capabilities [G] will be required to address the "*current scenario*"[64] mapped on the previous stages, in order to perform the following complementary strategies: (4) improve the *steering* (and *governance*) ability to respond faster and coordinately to the business goals; (5) eliminate, minimize or mitigate the imminent *threats*; (6) take better advantage of the *opportunities* identified.

[63] Moderator factors [M], strengths and weakness, identified at this stage; as well as the disturbing factors [E], threats and opportunities, analyzed at the previous stage.

[64] The set of components, agents, influences and behaviors, which describe the circumstances experienced by the organizational context in a specific iteration of the theory application.

As a second step of this stage, the team involved (on theory application) must apply agile capabilities [A] in a combined and coordinated manner with governance capabilities [G] upon the internal strengths to perform the strategies (4), (5), and (6), as demonstrated in **Competitiveness scenario ($\varphi_{5''}$)**, detailed in Section 4.5.3.5.

The operating of those strategies should generate positive impacts on the *business agility* and their *outcomes* that help the organizational context to upgrade its ability to sense and respond to changes in competitive and turbulent environments, in a progressive manner along the cycles.

4.6.2 Tracking theory application components in the lifecycle

Figure 4.36 depicts an example of the transformations carried out in each stage of the lifecycle. The *tracking network* is organized in pools and lanes using as reference the BPMN[65] (Zimmermann and Doehring, 2011), where each stage of the lifecycle is described as a pool (vertical representation), as well as each class of component (including theory constructs) is depicted as a lane (horizontal representation) to facilitate understanding of the interactions among them.

In addition, the constructs of the theory are represented by spheres, while other elements described in each stage are represented by cubes, such as: strengths, weaknesses, threats and opportunities.

The mapping of the actions and strategies of action are represented by continuous arrows, while dashed arrow represent the implied action related to an effect between the components connected. We choose the *red color* (— · —) to represent negative impact among components and the *blue color* (— - —) to represent positive impact.

In complement, the *density of the arrow* (thickness), also represent the intensity of the impact between the components related, e. g., situation where an impact previously characterized was nullified after an action of a third component is represented by a low density arrow (*thin dotted line*). Moreover, each arrow has a short text describing the meaning of the relationship.

[65] BPMN means Business Process Modeling Notation. We have chosen BPMN as it is a commonly used standard.

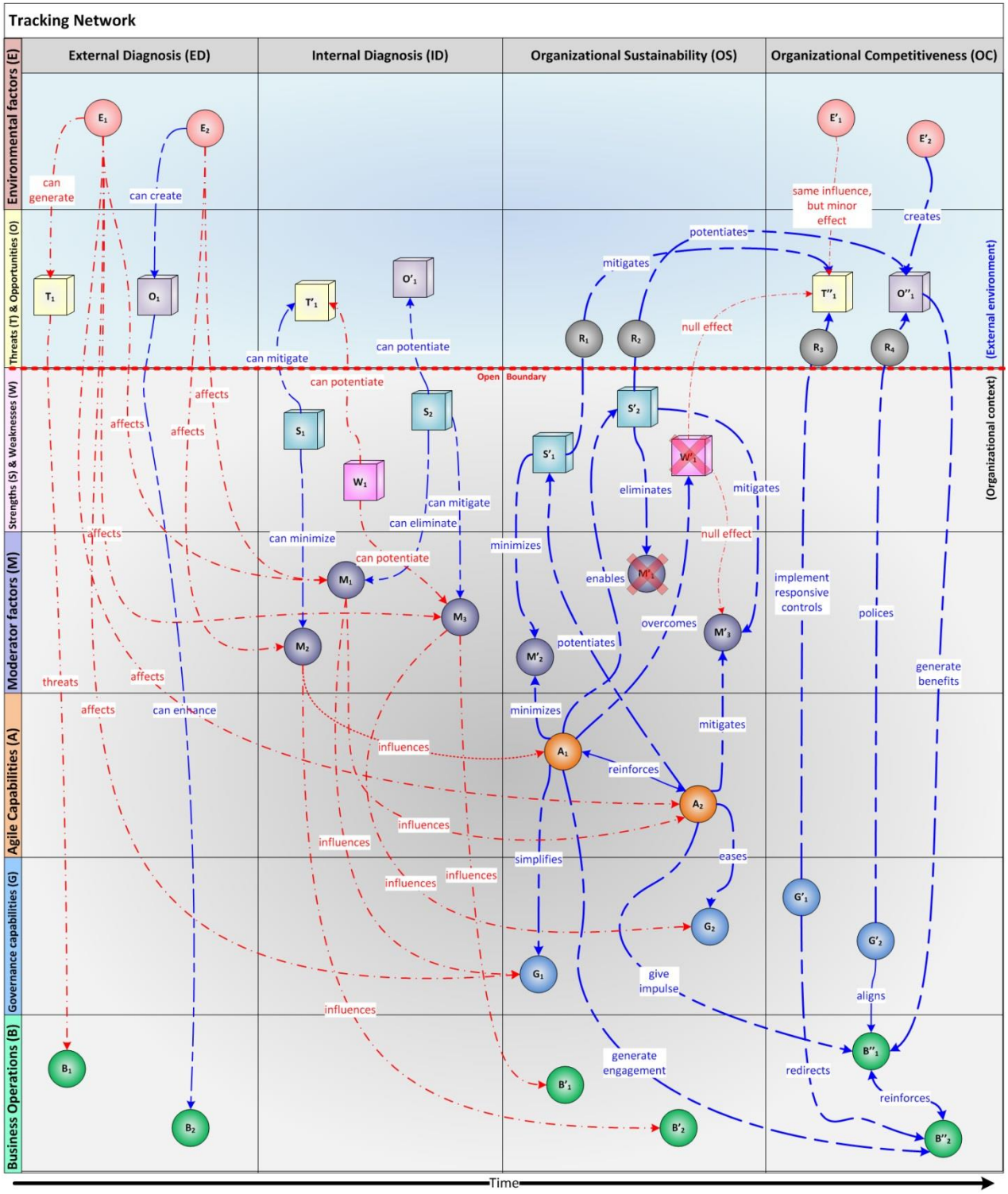


Figure 4.36 – Network tracking: illustrating the transformations in each stage of lifecycle. Source: Own elaboration.

Organizational competitiveness addresses the ability to be able to sense and respond to external changes, minimizing their negative impact on organizational context. On the other hand, ***organizational sustainability*** concerns to establish and maintain the best fit for each component part of the same *organizational context*, conducting them to the best level of readiness, reflecting and contributing to improve the ***organizational competitiveness***. In other

words, they are different, but complementary, concepts that work together to reach better *business agility*.

4.6.3 Lifecycle and timebox

During theory application, the management of iterations must be done by means of timebox[66] concept, i.e., the planning and execution of an iteration (theory cycle) should be considered an inflexible fixed time period, as well as the iteration scope should be proactively managed to meet that schedule.

In other words, the end date of a timebox is "frozen" and cannot be changed. If the team cannot successfully implement all the strategies for sustainability and competitiveness planned for the current iteration until the schedule deadline, the work will be continued (or re-prioritized) in a new iteration (timebox), considering lessons learned.

Whether we contemplate each time increment as a timebox, which can be understood as a subset in a lifetime of an organizational context, we can approximate the theory lifecycle to a process in four stages to guide people and organizations to describe their actions in terms of assimilate the theory application in a practical way.

The duration of the timebox should be as brief as possible. Nevertheless, it is understood that organizations with little experience in agile governance must start with a comfortable timebox, and reducing it to go as far as their progress and gain more experience.

4.6.4 MAnGve coupling

In a previous work, Luna (2009) has developed a framework for agile governance, in order to implement and improve governance in organizations, called MAnGve. This framework is focused to the deployment process, as a catalyzer to accelerate the deployment of governance. The MAnGve framework is designed to mitigate the lack of practical focus found in conventional governance models (MAnGve.org, 2009). The MAnGve is a framework based on an agile life cycle, seeking to translate the principles, values and practices from Agile Software Development to IT governance paradigm.

[66] A previously agreed period of time during which a team works steadily towards completion of some goal.

The MAnGve also adopts an iterative and incremental development, having a lifecycle consisting of several iterations, based on timebox concept, aiming to reduce risks for implement governance processes or services.

In MAnGve, for each iteration, equivalent to a full course of its lifecycle, is given the name of "tide", according to the analogy that the framework does in relation to the coastal ecosystem, transitional between terrestrial and marine environments, which originated its name (mangrove). In the MAnGve's lifecycle we can adapt the logical sequencing of each of the original processes to the theory application, namely: (1) Diagnosis; (2) Alignment; (3) Competencies development; (4) Backlog Management; (5) Planning for action; (6) Implementation; and, (7) Improvement.

In fact, we can use the MAnGve lifecycle to execute every stage of the theory lifecycle, as depicted in **Figure 4.37**, allowing a natural coupling between the Theory of Agile Governance application (current contribution) and the MAnGve framework (previous contribution), in order to implement (and improve) the theory internalization by the organizational context that is developing.

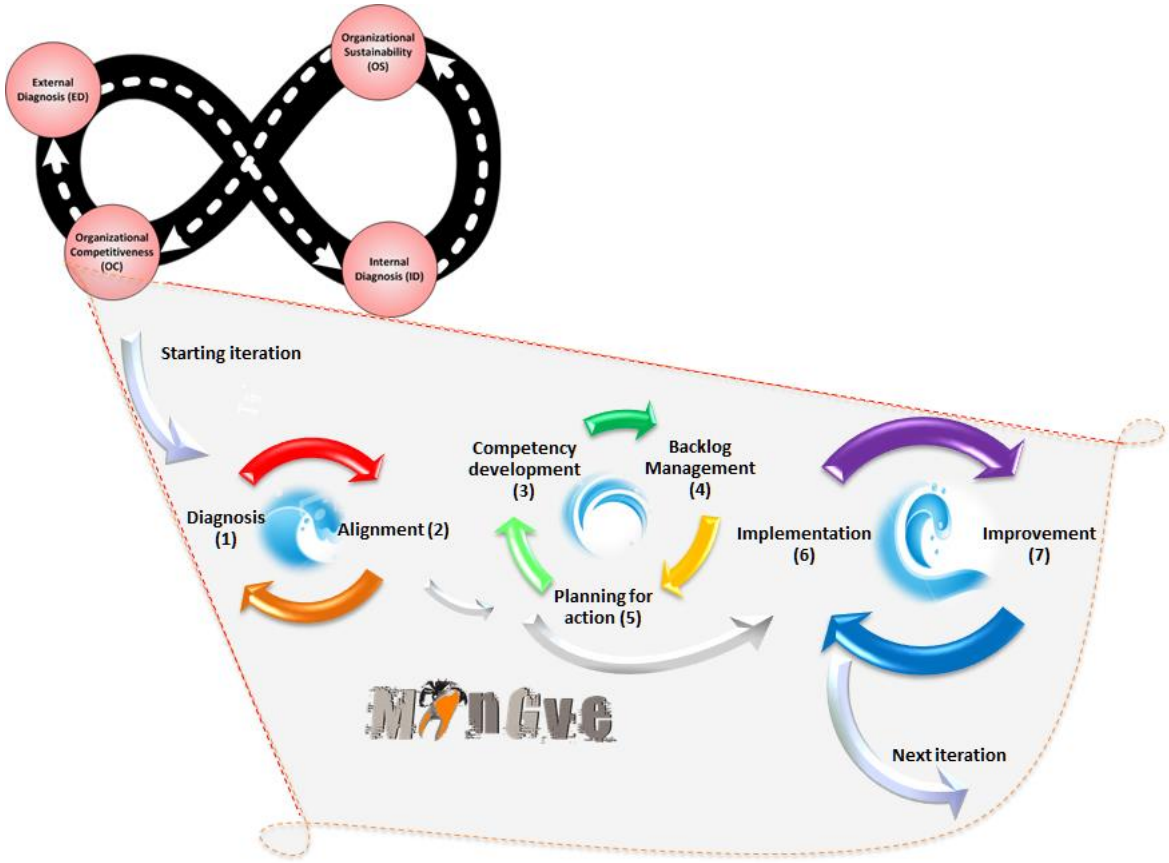


Figure 4.37 – Theory's lifecycle & MAnGve coupling. Source: Adapted from (Luna, 2011a, 2009).

In short, follows a brief description of each process, adapted to the theory application:

(1) **Diagnosis**: identify the current state of the organizational context and analyze the impact will be generated by the theory application, considering but not limited to: strategic planning, organizational structure, organizational climate (and culture), degree of customer satisfaction and degree of team experience.

(2) **Alignment**: define (or revise) and the alignment between the organizational context strategy and the overall business strategy trying to answer the questions: i) Which results are strategic to the business?; ii) What initiatives can they adopt to achieve those results?; iii) Which are the priority ones at this time?; iv) Which results can be achieved quickly, better, cheaper and most visible, to generate momentum for the team?

(3) **Competency development**: enable staff develop the agile competencies [A], the governance [G] (or other nature of competencies), needed to carry out the strategies planned for the scope of the current iteration. It is proposed that the training process focus on the Competency-based management (Campbell et al., 2010; Horey et al., 2004; Lawler, 1994), both to define the training scope and the evaluation process to assess the degree of assimilation of the team.

(4) **Backlog Management**: prepare, supplement or revise the list (backlog) containing short descriptions of all: environmental factor [E] should be confronted, opportunities should be seized, threats should be faced, moderator factor [M] should be attenuated (or eliminated), strengths should be reinforced, weakness should be treated, agile capabilities [A] and governance capabilities [G] should be developed and combined to do that. This process manages the all theory application components in its lifecycle, including improvement or removal of obsolete and unnecessary items, if any. (See **Figure 4.36** to get an idea of the magnitude and diversity of these components.)

(5) **Planning for action**: establish and maintain an Iteration Plan (tide plan or nautical chart) for the strategies prioritized in the Alignment process (2) for the current iteration. This plan will serve as a reference for the implementation of strategies during the theory application lifecycle.

(6) **Implementation**: put in action the Iteration Plan, implementing the strategies defined in its scope, according to the level of specified complexity and following the approach set out in it.

(7) **Improvement**: identify and plan the necessary improvements to strategies deployed. Although the MAnGve predicts the concept of continuous improvement, caution is advised in early iterations, where the focus should be to achieve visible results as soon as possible.

4.6.5 Time effect and evolution

In general the meaning of **maturity** is being more widely used to describe optimization of processes, being the essence of this approach the acquired capability to repeat a process (Pondy and Mitroff, 1979; Scott and Gerald, 2007). Despite this, this work will address maturity as an ability to achieve a new level of systemic organizational awareness, not only by the developed skill to reproduce effectively each stage of the lifecycle increasingly better, but also by the positive effect generated on the level of sustainability and competitiveness of the organizational context. In other words we will apply the meaning of maturity as the state or quality to be able to fully develop the organizational context, in terms of business agility.

Based on the previous sections explanation of the it is expected that occur a natural evolution of the theory constructs (as well as the organizational context development as a whole), in each cycle, for a consecutive sequence of cycles of the theory on the same organizational context.

As a natural consequence of the many subsequent cycles, we can suggest the increasing of the resultant of some constructs, such as:

i. **Agile capabilities [A]**, which by way of the organizational context can cultivate a agile culture expanding the team ability to describe their actions and decisions in terms of agile principles and values, applying these capabilities as enablers of the governance capabilities [G], potentiating and developing organizational forces, overcoming weaknesses and giving impulse to business.
ii. **Governance capabilities [G]**, which by virtue of the improvement of the steering (and governance) ability to respond faster to the business goals; allowing a more accurate and cognitive decision making process; prioritizing relevant aspects; glimpsing the long term, but without ignoring the need to respond quickly to changes in the present moment; and, re-evaluating the strategy when necessary.
iii. **Business operations [B]**, which by means of the achievement of a balanced level of organizational sustainability and competitiveness allow the entire organizational context

(processes, practices and activities) develop widely ability to sense and respond proactively, to generate their outcomes in a coordinated manner.

iv. **Value delivery [R]**, as a consequence of the improvement of the business operations [B] outcomes (e.g., by means of boost of team productivity, rising of team cohesion, etc.), we can imply a natural amelioration of the value delivered by them, either by reducing the delivery time of products or services (time-to-market), or other construct dimension (such as utility or warranty).

While the resultants of [A], [G], [B] and [R] increase, we can imply the resultant of the **moderator factors effects [M]** decrease, which the restraining factors are naturally eliminated, minimized or mitigated gradually cycle after cycle, reducing their inhibiting or constraining effect, by means of the effect of combination of [A] and [G].

On the other hand, we cannot indicate the variance in the resultant of the **disturbing factors from external environment [E]**, because they are resulting of combination factors that are out of the organizational boundary, and therefore, out of direct control and influence of the organizational context. However, the effects caused by them are gradually reduced cycle by cycle by increasing organizational competitiveness (by means of the effect of [A] and [G]), which makes the organizational context increasingly able to deal with their influence, reducing its harmful effects. In other words, the environmental factors maintain their influence upon organizational context, but their effects are reduced over time, after consecutives theory cycles, by increasing the capacity to handle with them by this same context.

The **Figure 4.38** depicts an illustrative evolution of a sequence of cycles of the theory. We can imply for each cycle of the theory an improvement of the values related to agile capabilities [A], governance capabilities [G], business operations [B], and value delivery [R]; while we can infer the reducing of the effects of moderator factors [M] and the effects of the disturbing environmental factors [E].

We also suggest that the evolution of these constructs should collaborate in building a more sustainable and competitive organizational context in each cycle, and is under this point of view that we apply the concept of organizational maturity on the cited figure.

We would like clarify that the value of maturity applied for each cycle of the **Figure 4.38** is not related to any maturity scale, such as CMMI (Software Engineering Institute, 2010a, 2010b) or COBIT (Software Engineering Institute, 2010a).

They are just a dimensionless numbers (of references) to expose the evolutionary ideas of the state (or quality) to be able to fully develop the organizational context, in terms of business agility. In addition, the equations depicted in **Figure 4.38** are merely illustrative of the general behavior of each construct, and should not be considered as exact descriptors of their behavior.

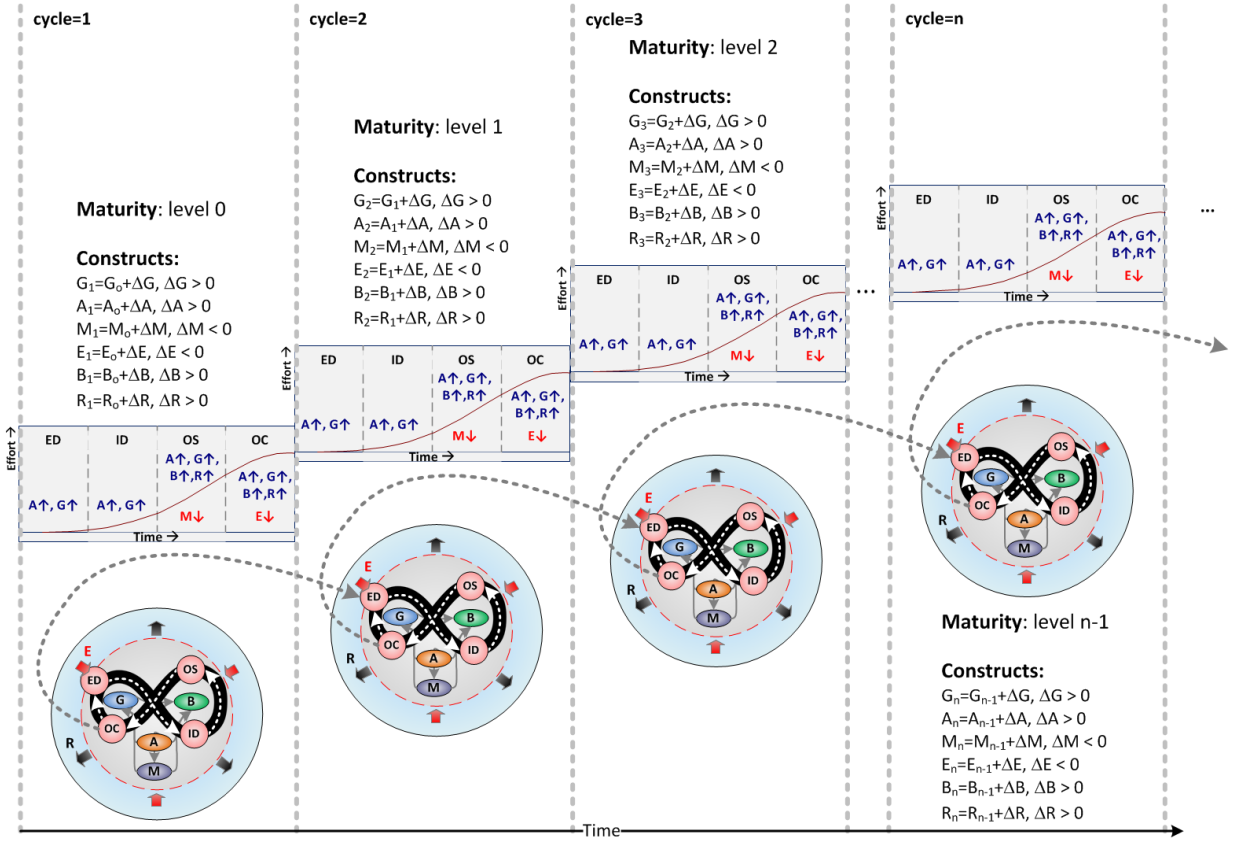


Figure 4.38 – Lifecycle evolution: illustrating the agile governance evolution in each theory cycle. Source: Own elaboration.

In each cycle of the **Figure 4.38** we can see a effort chart highlighting every stage of the lifecycle depicted in Section **Figure 4.35**: (1) External Diagnosis (ED); (2) Internal Diagnosis (ID); (3) Organizational Sustainability (OS); and, (4) Organizational Competitiveness (OC). The curve depicted by the charts suggests the effort applied by the organizational context to run each stage of the lifecycle.

According to these subjective estimates an increasing grade of effort is required to develop the theory lifecycle: beginning with a lower effort for the diagnosis stages (ED and ID), requiring a bigger effort of the entire organizational context to achieve a good level of sustainability (OS) at

the third stage, reaching a major effort at the fourth stage to reach a new level of competitiveness (OC).

The purpose of this Section was not to provide an accurate estimate of the relationship between the level of maturity achieved by the organizational context and the number of cycles of theory application, necessary to reach it. We have wished only to give to the reader some insights about the mechanics of the relationship between: (1) theory application and evolution of the organizational context maturity; (2) the level of effort required to implement each stage of the life cycle theory; and, (3) the behavior of values of theory units during consecutives theory cycles. Further discussion about these aspects should be future study topic.

4.7 THEORY UTILITY – motivation to use it

The Agile Governance Theory can be used by organizational contexts (teams and organizations) to:

1. Align whole of organizational context capability to the governance needs of the organization, adopting an agile approach in order to make them more responsive to changes in the business environment.
2. Identify any factor (environmental factor or inner moderator factor) which can have harmful effects on organizational context and that could be treated by: (1) avoidance (eliminate, withdraw from or not become involved); (2) reduction (optimize or mitigate); (3) sharing (transfer, outsource or insure); (4) retention (accept and budget).
3. Identify any gaps in competencies (skills, knowledge and behaviors) that could be eliminated, or competences that must be developed, encouraged or addressed through training or mentoring, to handle with those factors.
4. Assist executives and teams to become aware about their actuality and address their overall business strategy, giving them an adaptive and reflexive reference to find their own way toward maximizing the delivery of business value.

4.7.1 Adapting the Agile Governance Theory to your organization

As each organizational context is different, the theory, which is based on sophisticated and collective theory units, can be adapted (or instantiated, or particularized) to reflect the specific needs of every context. This may mean adapting the theory:

1. To reflect their unique culture, value and mission.
2. To align with key documents, for example the organizational policy and procedures.
3. To incorporate the language or terminology used in their organization.

If the organization has an existing governance framework (or it has adopted one of those from industry: ITIL, COBIT, etc.), this can be aligned with the Agile Governance Theory. If any gaps are identified, these can be added to the existing framework to meet their specific requirements.

4.8 Closing remarks

In its first part, this Chapter described the eight theory building steps adopted to develop the Agile Governance Theory, organized in two parts: (1) Section 4.3: Theory's conceptual development; and (2) Section 4.4: Theory's operation. Every step has had its methodological approach detailed to generate each of the theory's component, covering, respectively: the theory's *constructs*, its *laws of interaction*, its *boundary-determining conditions*, its *system states*, *propositions*, *empirical indicators*, *hypotheses*, and *research agenda* to begin testing the theory.

The Section 4.5 has discussed the theory's implications for research and practice, analyzing the theory as a system and confronting its behavior, by means of deductive logic lens, with real facts from the real world, in order to discuss its *coherence* and *usefulness*. In these discussions, each theory setting was treated as a theoretical scenario discussed in deep. In Section 4.6 we have presented some guidance to the theory *applicability*, in order to help the reader to make a practical use of knowledge provided by it, comprising: theory's application lifecycle, timebox concept, MAnGve coupling, as well as time effect and evolution aspects.

Finally, in Section 4.7 we have suggested motivation for theory use, and how the reader can adapt the emerging theory to his or her own organization. The next Chapter will describe in details the theory assessment according the established criteria.

Chapter

5

5. The Agile Governance Theory: assessment

This chapter aims to describe the procedures of assessment of the emerging theory from the previous chapter.

5.1 Introduction

In this chapter will be reported the theory assessment procedures, as follows. In Section 5.2, will be described the empirical study designed to assess the plausibility of the theory, including its planning, its development, as well as the results from study, the discussion of the impact from these findings upon the emerging theory, and their reflections in the theory refinement.

In turn, Section 5.3 presents other theories in Information System area to compare and contrast with the emerging theory, also to examine what is similar, what is different, and why, in order to enhance the internal validity, generalizability, and theoretical level of the theory building.

5.2 Empirical study

This section describes the design, development and findings of the study framed to assess the plausibility of the emerging theory fully detailed in previous Chapter. The type of empirical study chosen to assess the plausibility of the emerging theory is an explanatory survey, because we are interested in testing the theory and its causal relationships (Creswell, 2003; Freitas et al., 2000). We will dig deep about the study classification in Section 5.2.1.2.

5.2.1 Study design

This Section deals with the manner the empirical study was planned to test the hypotheses and refine the theory that emerged in the previous chapter. Following we will discuss the formulation of the theoretical model to assess the theory by means of the application of Structural Equation Modeling (SEM), and, finally we will describe the steps to develop the data collection instrument of survey research.

5.2.1.1 Formulation of the theoretical model

The conceptual model developed is derived from the theory described in Chapter 4, based on the relationships and influences of the factors affecting the *business agility*, under the context of *agile governance*.

In the first part, the structural sub-model is presented in a diagram of paths (Path Diagram) showing the causal relationships between the constructs (theory's units). Then each hypothesis from the emerging theory is depicted in the structural sub-model (see Section 4.4.3). In the second part, the observed variables (empirical indicators, Section 4.4.2) are associated to the respective construct (theory unit), forming the sub-model measure. After all, the complete structural equation model is presented, with its structural component and measurement.

5.2.1.1.1 Development of structural sub-model

From the Agile Governance Theory detailed previously (Chapter 4), a conceptual model with six constructs (**Table 4.3**) and sixteen hypotheses (**Table 4.23**) was formulated. This model is a representative and simplified version of the theory about agile governance and the relations among their constructs, disturbing factors, moderator factors and eventual mediation among them.

In this sense, the constructs *agile capabilities* [A] and *governance capabilities* [G] represent mediating variables between *effects of environmental factors* [E], *effects of moderator factors* [M] and *business operations* (B). In complement, the construct *business operations* [B] represent mediating variable between *agile capabilities* [A], *governance capabilities* [G] and *value delivery* [R].

Figure 5.1 depicts the conceptual framework proposed in the form of diagram of trajectories (*Path Diagram*). This set of latent variables (constructs) and their interactions form the structural sub-model SEM. The ellipses represent the endogenous latent variables *effects of environmental factors* [E], *effects of moderator factors* [M], *agile capabilities* [A], *governance capabilities* [G], *business operations* [B], and *value delivery* [R].

This version of the structural model represents the **Dynamic scenario (φ_n)** of the theory. We choose this scenario for develop a representative model from the emerging theory, because it

is the most complete of the scenarios depicted in Section 4.5.3, and it is the most characteristic of the theory scope.

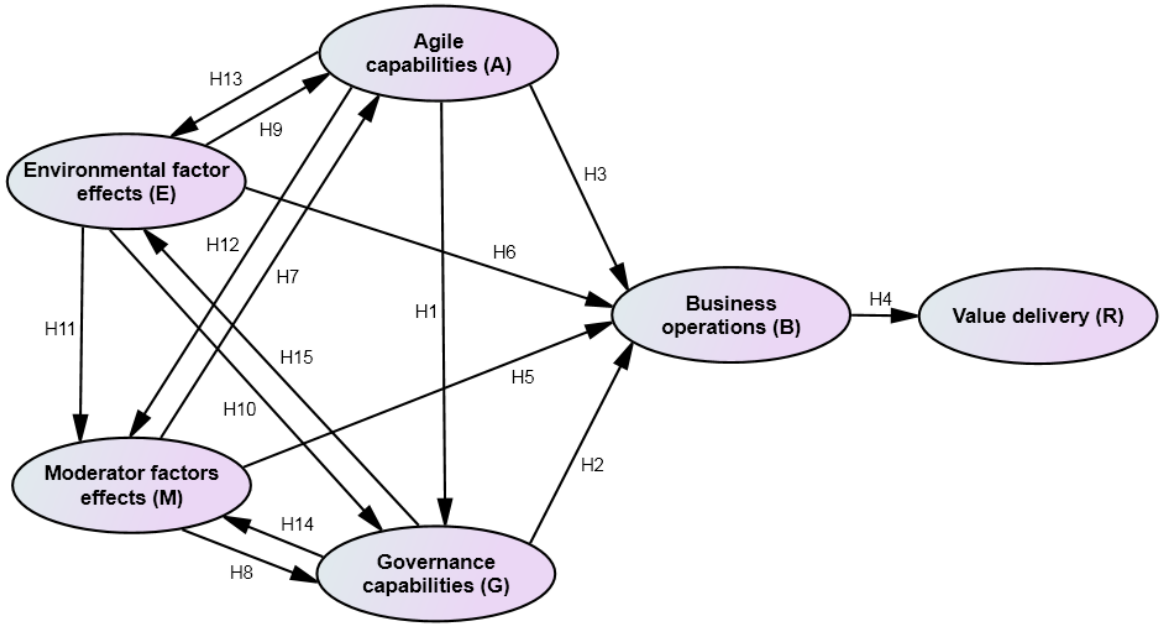


Figure 5.1 – Conceptual model derived from theory. Source: Own elaboration.

For instance, this scenario allows us to realize the largest number of the hypotheses depicted in **Table 4.23**, simultaneously. As a consequence, in the chosen scenario for the model elaboration no have exogenous variables, because it represents the behavior from other scenarios at the same time. While the other scenarios consider time dimension as a determinant issue that govern the sequence of the events related to the interactions of each construct, the **Dynamic scenario (φ_n)** of the theory deals with those interactions (described by the theory laws) occurring simultaneously as a function of the environment dynamics (what we have called **theory's quantum behavior** in Section 4.5.3.6). However, this issue will not be a problem, because when we will test the hypotheses, we will consider the context of each scenario at a time. In every case, during the data analysis the model depicted by **Figure 5.1**, which we will consider for modeling that follow, will have some variable (construct) or hypothesis suppressed, depending on the theoretical scenario being tested, but without changing the logic of hypotheses under scrutiny.

In addition, the arrows indicate the direction of influence between these variables. An attentive reader can observe that **Figure 5.1** is very similar to **Figure 4.13**. Indeed, we have done so to ensure the maximum resemblance between the proposed operation to emerging theory and the conceptual model that will serve as an object of assessment for the theory in question.

Moreover, the interactions among these six variables represented by unidirectional arrows, show understanding (*a priori*) how these influences occur. In this sense, each arrow expresses a causal hypothesis. These hypotheses can only be confirmed by means of empirical data, following the procedures that will be outlined in the next Sections.

5.2.1.1.2 Development of the measurement sub-model

The model in **Figure 5.1** consists of six constructs or latent variables representing concepts or factors without direct observable physical existence. We can only measure these latent variables by observing indicator or manifest variables, the latter directly measurable (Marôco, 2014).

For example, the construct "*effects of environmental factors (E)*" cannot be measured directly because the "*environmental factors*" is a concept; however, the manifestations of this concept as the "*the degree of influence of regulatory institutions*" and "*the level of competitiveness of this environment*" can be measured (see the set of empirical indicators identified for each construct in **Table 4.20**). In SEM modeling, *latent variables* (constructs) and *manifest variables* (observed) relate in multiple linear equations, forming a representative set of an *explanatory theory* of a particular phenomenon.

Following the SEM methodology, the structural sub-model should be complemented with the formulation of the measurement sub-model, which is formed by the set of *manifest variables* operationalizing (measuring) each of the six *constructs* studied. At this stage, the *empirical indicators* identified in Section **4.4.2** were used to define the *observed variables*, as presented in **Table 4.20**.

Furthermore, we have some difficult for the formulation of the measurement components, because of the specific context in which they develop agile governance phenomena, and due the lack of empirical studies in this area.

As a standard of SEM representation, the *exogenous latent variables* are identified by the Greek letter *ksi* (ξ) and its *variables manifest* by the letter "x", following the traditional notation of the *independent variables*. *Endogenous latent variables* are identified by the Greek letter *eta* (η) and their respective *indicators* by the letter "y", indicating that it is *dependent variables*. We will adopt this notation during the adjusting of the **general model of the theory** based on the

Dynamic scenario (φ_n), and during the analysis of the remaining scenarios depicted by the emerging theory in Section 4.5.3.

Each set of observed or *manifest variables* in **Table 4.20** measures a specific *construct* (theory unit). In the step of empirical validation of the model, the consistency of these measurement components will be evaluated.

5.2.1.1.3 Model of structural equations

The structural equation model is a statistical model called "reflective model". In these models, the *latent variables* are *manifested* in the *observed variables* or using the language of *factor analysis*, the *latent variables* are the factors that produce effects on the *manifest variables*.

Additionally, as reported by Marôco (2014), the set of *manifest va*riables that measures a *construct*, is encoded to evolve in the *same conceptual sense*, in other words, the *manifest of the same construct variables are positively correlated with each other*. This nature of SEM is perfectly aligned with the Dubin's statement about multiplicity of indicators, when he points out that "*the population sample is ordered in the same way by the values measured by the several empirical indicators*" (1978, p. 197). Otherwise, when *multiple indicators produce different orderings of the same popula*tion, this means that *they cannot be measuring*, or standing as an indicator for, the *same theoretical unit*. Obviously, under these circumstances it is necessary to decide which of the empirical indicator we should discard (Dubin, 1978, p. 198).

Figure 5.2, following SEM patterns, presents the structural equation model describing the influences of the *effect of environmental disturbing* [E] and *inner moderators factors* [M] upon the *business operations* [B] in the *organizational context* under study, as well as the operation of *agile capabilities* [A] and *governance capabilities* [G] over this system for influence positively the *value delivery* [R].

This causal model has **five** *latent mediating variables* representing, respectively, the *effects of environmental factors* [E], *effects of moderator factors* [M], *agile capabilities* [A], *governance capabilities* [G] and *business operations* [B]. The model consists of two sub-models: i) **structural sub-model**: gray area; and, ii) **measurement of sub-model**: set of indicators outside the gray area. The structural sub-model includes **six** *constructs* (ovals) and their *interactions* or *causal*

relationships (one-way arrows). The measurement of sub-model is formed by particular sets of *manifest variables* (rectangles).

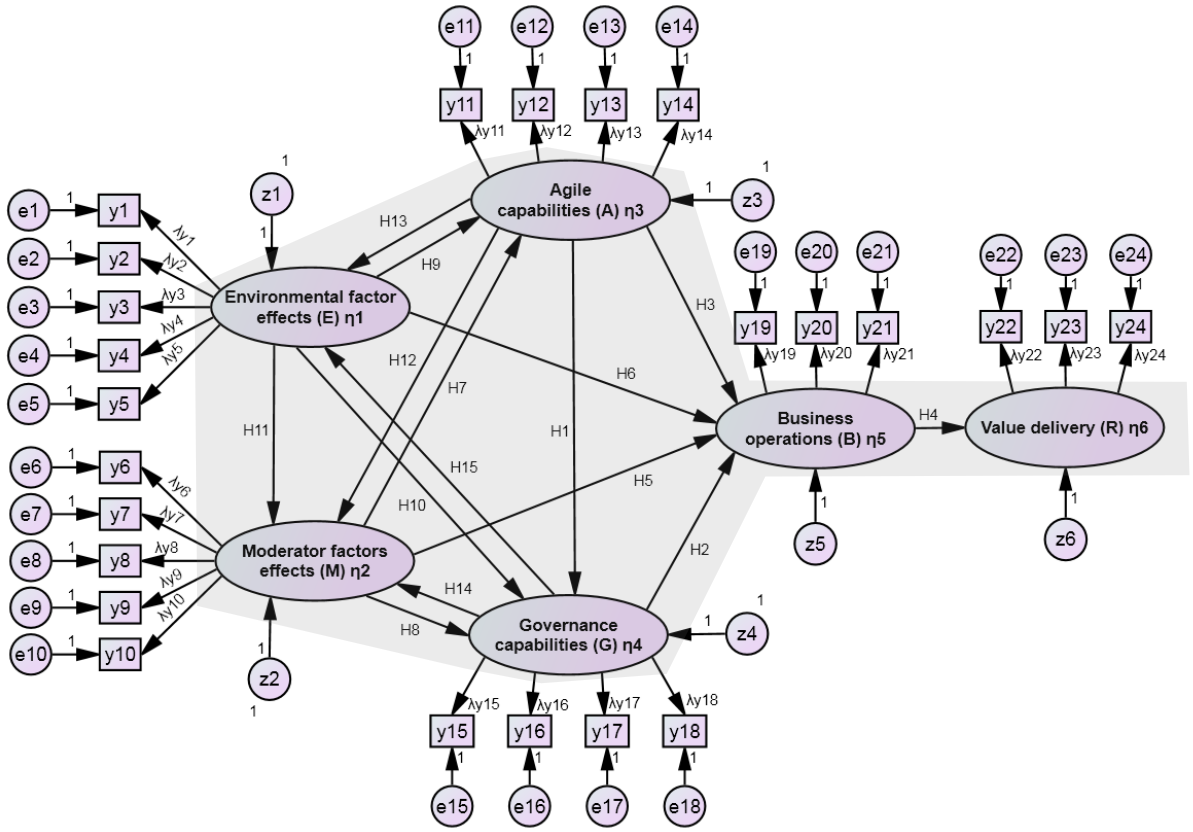


Figure 5.2 – Theoretical model of structural equations of the factors affecting the agile governance: theory general model based on Dynamic scenario (φ_n). Source: Own elaboration.

It is observed in **Figure 5.2** a model of **none** *exogenous variables* (independent), because we have based the **theory general model** on the **Dynamic scenario (φ_n)**, due this scenario is the most complete one, and it allows us to realize the largest number of the hypotheses depicted in **Table 4.23**, simultaneously. We will use the **theory general model** based on the **Dynamic scenario (φ_n)** in the following sections of this chapter, to address many aspects of the theory testing, unless explicitly mentioned. Indeed, the remaining scenarios depicted in Section 4.5.3 are simplification of the scenario (φ_n), what allow us during the data analysis, adjust the **theory general model** according the hypotheses under scrutiny without changing the logic of hypotheses being tested. As a consequence of each scenario analysis, some variables that were *endogenous* (dependent) can become *exogenous* (independent), and vice-versa.

On the other hand, there are **six** *endogenous variables* (dependent): ***Effects of environmental factors* [E] (η_1)**, operationalized by **five** *dependent variables* (y_1 to y_5); ***Effects of moderator factors* [M] (η_2)** whose set of measurement is formed **five** *indicators* (y_6 to y_{10}); ***Agile***

***capabilities* [A] (η_3)**, operationalized by **four** *dependent variables* (y_{11} to y_{14}); ***Governance capabilities* [G] (η_4)**, measured by **four** *manifest variables* (y_{15} to y_{18}); ***Business operations* [B] (η_5)**, operationalized by **three** *dependent variables* (y_{19} to y_{21}); and, ***Value delivery* [R] (η_6)** measured by **three** *manifest variables* (y_{22} the y_{24}).

The **error terms** of the *independent variables* would be represented by δ, while the error associated with each *dependent variable* is represented by ε (ε_1 to ε_{24}); both δ and ε represent the *part not explained by the factor* (construct) the *variable manifest* and which would be explained thus *by other factors* (variables) *not considered in the model*.

Similarly, *endogenous latent variables*, η_1 to η_6, have their causes in their relations, and the unexplained part is attributable to the **error** or disturbance *z* (*z*1 to *z*6). The factorial weights represented in the model by the Greek letter *lambda* ($\lambda_{y_1}$to $\lambda_{y_{24}}$), and the structural coefficients characterized by the hypotheses (H_1 to H_{15}), are depicted in order of cause and effect. For example, the factorial weight of the factor η_1 in y_2 is λ_{y_2}.

Similarly, H_1 is the *structural coefficient* or *regression coefficient* between η_3 and η_4. It is noteworthy that the constructs of this model were not listed in previous research, indicating the originality of this study. The SEM model of **Figure 5.2** can alternatively be represented by a set of *linear equations*, as is exhibited in **Table 5.1**. As a matter of clarification, in the equations of the **Table 5.1**, we prefer replace the Greek letters, related to every constructs by the representative letters of each theory's units (in the modern English alphabet), presented in **Table 4.3**.

The structural equation model depicted in **Figure 5.2**, as highlighted by (Gil, 2009; Groves, 1989; Kaelbling et al., 1996; Krosnick, 1999; Synodinos, 2003), has following assumptions: i) ε and η are *independent*; ii) δ (if it exists) and ξ (if it exists) are *independent*; iii) z and ξ (if it exists) are *independent*; iv) z, ε, and δ (if it exists) are *mutually independent*; v) the expected values of the errors are zero (0).

As a result, the **Equation 5.7** is the *General Equation* of the Structural theoretical model, derived from the most complex *theoretical scenario* depicted from Agile Governance Theory, Dynamic scenario (φ_n), can be transcribed in *colloquial terms* as:

> *"Value delivery [R] can be described as result of the influence from disturbing Effects of external environmental factors [E], restraining Effects of inner moderator*

factors [M], as well as the enhancers effects from Agile capabilities [A] and Governance capabilities [G], upon the Business operations [B], and their interactions, into the organizational context under study".

Table 5.1 – Equations representing the theory general model based on Dynamic scenario (φ_n). Source: Own elaboration.

(I) Structural sub-model:	
$E = H_{13}A + H_{15}G + z_1$	**Equation 5.1 –** Effects of external environmental factors [E]. Source: Own elaboration.
$M = H_{11}E + H_{12}A + H_{14}G + z_2,$	**Equation 5.2 –** Effects of inner moderator factors [M]. Source: Own elaboration.
$A = H_9E + H_7M + z_3,$	**Equation 5.3 –** Agile capabilities [A]. Source: Own elaboration.
$G = H_{10}E + H_8M + H_1A + z_4,$	**Equation 5.4 –** Governance capabilities [G]. Source: Own elaboration.
$B = H_6E + H_5M + H_3A + H_2G + z_5,$	**Equation 5.5 –** Business operations [B]. Source: Own elaboration.
$R = H_4B + z_6,$	**Equation 5.6 –** Value delivery [R]. Source: Own elaboration.
$\therefore \boldsymbol{R = H_4(H_6E + H_5M + H_3A + H_2G + z_5) + z_6}$	**Equation 5.7 –** General Equation of the Structural theoretical model. Source: Own elaboration.

(II) Measurement sub-model from the construct Effects of external environmental factors [E]:

$$y_1 = \lambda_{y_1}E + e_1$$

$$y_2 = \lambda_{y_2}E + e_2$$

$$y_3 = \lambda_{y_3}E + e_3$$

$$y_4 = \lambda_{y_4}E + e_4$$

$$y_5 = \lambda_{y_5}E + e_5$$

(III) Measurement sub-model from the construct Effects of inner moderator factors [M]:

$$y_6 = \lambda_{y_6}M + e_6$$

$$y_7 = \lambda_{y_7}M + e_7$$

$$y_8 = \lambda_{y_8}M + e_8$$

$$y_9 = \lambda_{y_9}M + e_9$$

$$y_{10} = \lambda_{y_{10}}M + e_{10}$$

(IV) Measurement sub-model from the construct Agile capabilities [A]:

$$y_{11} = \lambda_{y_{11}} A + e_{11}$$

$$y_{12} = \lambda_{y_{12}} A + e_{12}$$

$$y_{13} = \lambda_{y_{13}} A + e_{13}$$

$$y_{14} = \lambda_{y_{14}} A + e_{14}$$

(V) Measurement sub-model from the construct Governance capabilities [G]:

$$y_{15} = \lambda_{y_{15}} G + e_{15}$$

$$y_{16} = \lambda_{y_{16}} G + e_{16}$$

$$y_{17} = \lambda_{y_{17}} G + e_{17}$$

$$y_{18} = \lambda_{y_{18}} G + e_{18}$$

(VI) Measurement sub-model from the construct Business operations [B]:

$$y_{19} = \lambda_{y_{19}} B + e_{19}$$

$$y_{20} = \lambda_{y_{20}} B + e_{20}$$

$$y_{21} = \lambda_{y_{21}} B + e_{21}$$

(VII) Measurement sub-model from the construct Value delivery [R]:

$$y_{22} = \lambda_{y_{22}} R + e_{22}$$

$$y_{23} = \lambda_{y_{23}} R + e_{23}$$

$$y_{24} = \lambda_{y_{24}} R + e_{24}$$

The next chapter discusses the methodological steps for the empirical validation of the model, namely the *sample selection*, the *development of the survey instrument* and the *choice of statistical techniques* for the processing of data.

5.2.1.2 Survey research as empirical study

To assess the plausibility of the theoretical model, it must be confronted with reality. Thus, we defined the application of a survey research for the survey of empirical data. A survey applies typically when there is interest in obtaining quantitative descriptions of a predefined population. The survey of data from this population is made by means of a specific instrument (Gil, 2009; Groves, 1989; Kaelbling et al., 1996; Krosnick, 1999; Synodinos, 2003).

Krosnick (1999), Pinsonneault and Kraemer (1993), and Synodinos (2003) characterize the survey research following these dimensions: i) **purpose**: the purpose of the research is to produce quantitative descriptions of some aspects of the study population, the survey research focuses on the relationships between the variables and the projection of descriptive findings from a predefined population, the subjects studied can be individuals, groups, organizations, projects, applications or systems; ii) **form of collection**: the main form of collection is to ask the respondents information using structured and predefined questions, the answers may refer to himself or some other unit of analysis, constituting the data to be analyzed; iii) **amplitude**: information is usually collected on only a fraction of the study population (a sample), but is collected in a way that allows to generalize the results to the population, usually the sample is large enough to allow extensive statistical analysis.

The **research survey** applies when the researcher identified the *independent variables* and *dependent* on a particular model with causal relationships. In this case the model needs to be tested with empirical data from the survey. According to the purpose of study, the research survey may be: i) **exploratory**: when applied to identify the likely range of responses on any population of interest and thus enhance the measurement of the concepts; ii) **descriptive**: to discover what situations, events, attitudes or opinions characterize a population, the concern is to check facts, does not testing theories or causal hypotheses; and, iii) **explanatory**: when *testing a theory* and *its causal relationships*, that is made from theoretically based expectations about how and why the variables are related (Creswell, 2003; Freitas et al., 2000).

In this study, we seek assess a theory about agile governance and the relations among their constructs, disturbing factors, moderator factors and eventual mediation among them. In this case, the theory includes elements of cause and effect, since not only presupposes the existence of relationships between variables in the model, but also it assumes the *directionality of interactions*. For these reasons, the research "***explanatory survey***" was considered the most appropriate for this purpose.

The phenomenon under study comes to *agile governance phenomena*, their *components* and *how they interact*, this phenomena occur *over time* and *continuously*, however, in this study, the research is *cross-sectional* because the *perception of the representative agents from those phenomena are evaluated in a specific space time*, that is, the period in which the survey research was conducted (between January 15 and April 19, 2015).

Moreover, this empirical research is part of a broad research, in which the research framework is detailed in Chapter 2, and depicted in **Figure 2.1** and itemized in **Figure 2.2**. This type of research can be classified as *multi-method* or *mixed* (Gil, 2009; Krosnick and Presser, 2010; Malhotra, 2006) therefore applies in combination systematic literature review, observation on professional groups based on social networks, and semi-structured interviews with emphasis on qualitative aspects; and the *cross-sectional research explanatory survey* with quantitative approach.

5.2.1.3 Development of the data collection instrument

We can set questionnaire as research technique that consists of a set of questions that are submitted to persons for the purpose of information on knowledge, perceptions, beliefs, feelings, values, interests, expectations, aspirations, fears, present or past behavior, among others (Field, 2003; Lumsden, 2007; Marconi and Lakatos, 2003).

The development of questionnaire, as a research instrument, requires the observance of precise rules in order to increase its effectiveness and validity. In the organizational context where this instrument will be applied, should take into consideration the types, order, the question groups, the formulation thereof and also all that is known about perception, stereotypes, defense mechanisms, leadership, etc.; about the profile of the people who will answer it (Field, 2003; Lumsden, 2007; Marconi and Lakatos, 2003).

5.2.1.3.1 Validating the data collection instrument

The questionnaire was developed based on the structure of the theoretical model devived from the emerging theory in order testing the hypotheses characterized in Section 4.4.3. However, other sources of perceptions and knowledge developed during this research were considered during its development, such as: findings from our systematic review (SLR-AG); findngs from Semi-structured interviews carried out along with representative agents from the agile governance phenomena (SSI-AG); and observation and interactions along with members of Social Networks, of professional nature, related to the phenomena in study (SNME).

The first version of the questionnaire was comprised of 48 questions, in order to collect data about the six constructs of the conceptual model derived from emerging theory, as well as

included some questions to characterize the respondent mindset, and qualify the sample population.

Following the suggestions of Pinsonneault and Kraemer (1993), the questionnaire was originally tested in form and content, along with scholars and practitioners members of the sample population, by means of semi-structured interviews, using the questionnaire as a script. This first refinement initiative has generated a new questionnaire version containing 40 questions, for which we carried out a pilot Survey, as a second validating stage of the data collection instrument.

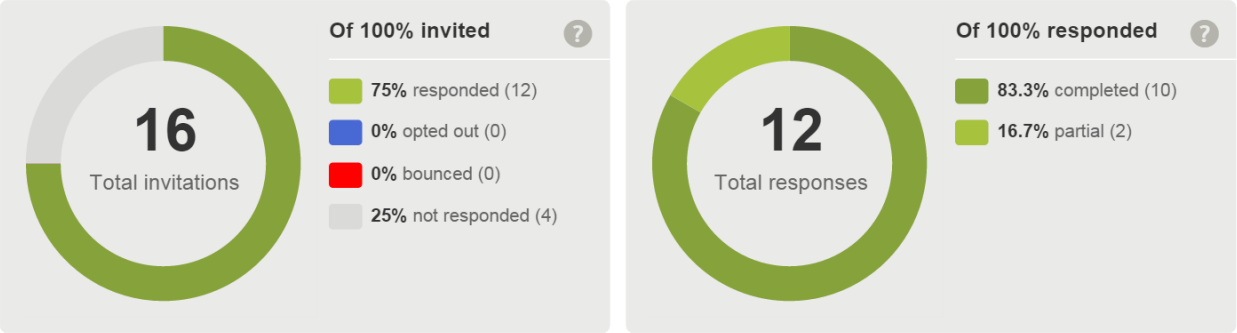


Figure 5.3 – Survey pilot: sampling ($n = 10$). Source: From Survey Pilot data at SurveyMonkey.

As a consequence, we developed a study protocol to perform the pilot Survey and we have executed the pilot study for assess the second version of the questionnaire, along with academics and representative members of the study population.

Table 5.2 – Pilot Questionnaire: questions profile. Source: Own elaboration.

Question profile	Questions	%
Questions about the positioning of the subject mindset	3	8%
Questions about constructs and their relationships	24	60%
Questions related to respondent and its demography	8	20%
Questions related to Survey analysis	3	8%
Questions related to Survey feedback	2	5%
	40	100%

The Survey pilot was carried out between December 12 and 23, 2014. We have invited *15 representative members*[67] of the sample chosen (see defined profile in Section 5.2.1.5). We received 12 answers, being 2 of them partial answers and 10 of them complete answers (all questions of the questionnaire were filled by this subgroup). **Figure 5.3** depicts some basic statistics about the Survey Pilot, we had a response rate around 66.67% (obtained by 10

[67] In **Figure 5.3** we have included our own email address to monitoring the invitation emails, because of this we should deduct one invitation from the left part of that figure, summarizing: 16 – 1 = 15 invitations.

completed responses out of 15 invitations). More details about Survey pilot statistics and its sample characterization is available at APPENDIX IV.

In turn, **Table 5.2** depicts the structure of the pilot version of the questionnaire with 40 questions that have intended to be used in the survey. We also were addressing the Dubin's criteria of *validity* and *instrument reliability* to evaluate the questionnaire (Dubin, 1978, p. 185), that are reinforced by (Maurer and Pierce, 1998, p. 6) as an essential pre-scrutiny procedure. Due that, during the pilot we have asked respondent to assess each question of the pilot questionnaire using the following criteria depicted in **Table 5.3**.

Table 5.3 – Pilot questionnaire: key criteria and assessment scales. Source: Own elaboration.

Criteria	**Assessment scale**									
Illustrative Legend	☹ **Strongly Disagree**		☹ **Disagree**		😐 **Indifferent**		☺ **Agree**		☺ **Strongly Agree**	
Numeric Scale	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
(1) Clarity: Is the text of the question **clear** to communicate the intended purpose?	No Clarity	Very little clarity	Unclear	Slightly clear	Nearly clear	Clear enough	Clear	Very clear	Strongly clear	Totally clear
(2) Validity: Does the text of the question **measure the construct that it should measure** (i.e., it characterizes well the variable that it represents)?	No valid	Very little validity	Shortly valid	Slightly valid	Nearly valid	Valid enough	Valid	Very valid	Strongly valid	Fully valid
(3) Reliability: Is the text of the question **consistent** in its measure (i.e., it is reliable for what it should to measure)?	No reliability	Very little reliability	Slightly reliable	Partially reliable	Nearly reliable	Reliable enough	Reliable	Very reliable	Strongly reliable	Fully reliable
(4) Relevance: Is the text of the question **relevant** to the questionnaire context? (The discrepancy indicates that the question could be discarded before the final version of the questionnaire)	No relevance	Very little relevance	Hardly relevant	Poorly relevant	Nearly material	Material enough	Relevant	Very relevant	Strongly relevant	Totally relevant
(5) Pilot answer: Considering this version of the questionnaire as a PILOT, what is your answer to this question?	Very strongly disagree	Strongly disagree	Very disagree	Disagree	Very indifferent	Little Indifferent	Agree	Very agree	Strongly agree	Very strongly agree

For the statistic method chosen by this study (SEM), the measurement scale of the questionnaire, strictly speaking, should be continuous to allow calculating the average, variance and covariance, necessary to estimate the model parameters. However, the use of discrete ordinal scales (Likert) in practice is quite common (Maurer and Pierce, 1998). Lomax and Schumacker (2012), and Marôco (2014) state that a greater number of classes in ordinal scale approximates the results to a corresponding quantitative metric. In this research was used an ordinal scale of 10 points by following these recommendations. **Figure 5.4** depicts an

example of a question bringing together the question statement, assessment criteria and answer scale.

Question ID	**4**	**Construct**	Effects of environmental factors [E]	**Variable**	Regulatory institutions
English	I have already experienced changes (or other disturbances) on the business operations due the influence of regulatory institutions of the environment where the organizational context was inserted (e.g., government, supervisory bodies, etc.).				
Portuguese	Eu já vivenciei mudanças (ou outras perturbações) nas operações de negócio devido, à influência de instituições reguladoras do ambiente onde o contexto organizacional estava inserido (e.g., governo, órgãos de fiscalização, etc.).				

Criteria	**Assessment scale**									
Illustrative Legend	**Strongly Disagree**		**Disagree**		**Indifferent**		**Agree**		**Strongly Agree**	
(1) Clarity	1	2	3	4	5	6	7	8	9	10
(2) Validity	1	2	3	4	5	6	7	8	9	10
(3) Reliability	1	2	3	4	5	6	7	8	9	10
(4) Relevance	1	2	3	4	5	6	7	8	9	10
(5) Pilot answer	1	2	3	4	5	6	7	8	9	10

Figure 5.4 – Pilot questionnaire: example of question. Source: Own elaboration.

As described in the Survey Pilot protocol we had to discard the incomplete responses of the questionnaire. In general, the assement accomplished by the respondents, has confirmed the clarity, validity, reliability and relevance of the questions in statistical terms. For instance, we can mention that the statistical distribution of the values attributed by the respondents during the pilot questionnaire assessment were within the standard deviation range for each question, in the "agreement spectrum" from the measurement scale (values from 7 to 10).

However, the most relevant contribution of the Survey pilot was comments and suggestions from respondents in order to refine the questionnaire and improve it. For example, this feedback allowed us: reviewing questionnaire structure, revaluating sequence of questions, improving text clarity (questionnaire instructions and question statements), wiping unnecessary texts, adding some links to some keywords, creating a glossary to avoid misunderstanding, aligning understanding of some key concepts, bettering questionnaire interface, remodeling questionnaire usability and navigation, among other improvements.

As a result, it was possible generate a new and enhanced version of the questionnaire for application during the data collection phase of the survey, when we have gathered the survey data for theory assessment. The pilot experience, also, has allowed us to refine the Survey Pilot protocol, generating a new version of the protocol for the Survey. Both, the final versions of the Survey questionnaire and protocol are available in APPENDIX VI.

5.2.1.4 Definition of the sample size

As advocated in Section 3.7.10 , agile governance is a nascent field of study, with very few relevant authors, and serendipitous practitioners. Because of this, the estimation of the sample size becomes a challenging effort. As alternative, based on the nature of the phenomena under study and in the multidisciplinary approach from agile governance, we are using the ***theory's external boundary-determining criteria*** (see Section 4.3.3) to define the profile of the participants, since we wish address representative agents of the phenomena in study.

We have looked for some reference that can give us a number to estimate the study sample size (Gil, 2009; Marconi and Lakatos, 2003). As a matter of concrete reference, we found the report of the IBGE (2009) on the Brazilian sector of Information Technology (IT), which has been used as the basis for the definition of the sample size, since it appears that, in 2006, the country had 65,754 companies which employed 673,024 people in the area of Information System /Information Technology (IS/IT). It is important to highlight that the IBGE report was chosen only as a population reference, where would be found the representative agents from the phenomena under study, in order to outline a first idea of sample sizing to this study.

According to Gil (2009), by **Sampling theory**, it is necessary to adopt the **Equation 5.8** to calculate the sample for infinite populations, because the real sample universe together exceeds 100,000 elements. In other words, independently if the sample is concentrated in a country or geographically distributed around the world, based on the Sampling theory, we can use **Equation 5.8** for any sample that exceeds 100,000 elements.

$$n_{Sampling\ theory} = \frac{\sigma^2 \times p \times q}{e^2}$$

Equation 5.8 - Sample sizing according to Sampling theory. Source: (Gil, 2009).

Where:

n = $sample\ size$

σ^2 = $confidence\ level\ selected, expressed\ in\ number\ of\ standard\ deviation$

p = percentage with which the phenomenon occurs

q = $additional\ percentage\ (100 - p)$

e^2 = $maximum\ error\ allowed$

For this study we used the probability sampling of the type stratified proportional (Gil, 2009; Marconi and Lakatos, 2003). The study considered the population for the research, over than 100,000 experts in IS/IT. Hence, we have planned, in statistical terms, an infinite population.

It was established that the percentage with which the representative agents of the agile governance phenomena can be found within IS/IT population is located around 3.0%, so *"q"* is equal to (100 - 3), i.e., 97. This percentage *(p)* was was arbitrated considering agile governance as a nascent field of study, with very few relevant authors, and serendipitous practitioners (Luna et al., 2014b).

In turn, we have adopted a *confidence level* of 99.7% (corresponding to *three standard deviations*) and a *maximum error* of 5.0%. Applying the formula met the following result:

$$n_{Sampling\ theory} = \frac{3^2 \times 3 \times 97}{5^2} = \frac{2619}{25} = 104{,}76 \cong 105$$

Therefore, to meet the requirements established by the study, according to sampling theory, the minimum sample size, i.e., the minimum number of the respondents for the survey should be at least 105 representative agents from agile governance phenomena. However, it is important to clarify that this sample sizing should be applicable for random sample selection, which is not feasible in this study for the population size identified as representative agents from agile governance.

On the other hand, considering the statistical representativeness related to application of the **Structural Equation Modeling (SEM)** and **Confirmatory Factor Analysis (CFA)** methods, the sample size is described as follows. For the sizing of the sample required for SEM analysis, Marôco (2014, p. 29) points out that the best alternative for the dimensioning of the sample is the one proposed by Westland (2010), which suggest the use of the **Equation 5.9**, in which (p) means the *number of items* or *manifest variables* and (f) is the *number of latent variables* or *factors* of the model, as well as $(\mathrm{r} = \mathrm{p} \ / \ \mathrm{f})$ determines the number of *manifest variables* by *construct*.

$$n_{SEM} \geq 50r^2 - 450r + 1100$$

Equation 5.9 - SEM sample sizing. Source: (Westland, 2010).

According to **Equation 5.9**, the Confirmatory Factor Analysis (CFA) for the model of the **Figure 5.2**, comprising **six** *constructs* and **24** *manifest variables*, in which $\mathrm{r} = 4$, would require at least $\mathrm{n_{SEM}} = 100$ observations (valid cases from questionnaire).

$$n_{SEM} \geq 50 \times 4^2 - 450 \times 4 + 1100, \therefore n_{SEM} \geq 100$$

The sample size estimated for the *SEM method and CFA* ($\mathrm{n_{SEM}}$) is even smaller than the sample size estimated by *Sampling theory* ($\mathrm{n}_{\text{ Sampling theory}}$), i.e., $\mathrm{n}_{\text{ Sampling theory}} > \mathrm{n}_{\text{ SEM}}$. Then to meet the requirements established for the study, the number of elements of sample should have to answer at least 105 representative agents of the phenomena in study ($\mathrm{n}_{\text{ minimum}} = \mathrm{n}_{\text{ Sampling theory}} = 105$).

5.2.1.5 Definition of the respondent profile

In order to minimize any bias possibility, we are considering the respondent profile, depicted in **Table 5.4**, as subset of the IS/IT adopted in the sample calculation, as criteria to choose the sample of this study.

Table 5.4 – Questionnaire: respondent profile. Source: Own elaboration.

Criteria	Description
(1) Qualification	Researchers (scholars) or professionals (practitioners).
(2) Experience	Who has experience (academic and/ or professional) in: (a) **governance capabilities**: ability to develop competencies related to way as an organizational context is conducted, administered or controlled, i.e., strategic alignment, decision making, control, compliance ability, steering skills, policy making, accountability, etc. (b) **agile capabilities** (agile or lean methods): ability to develop competencies related to principles, values and practices, from agile and lean philosophy, i.e., flexibility, "doing more with less", agility, adaptability, resilience, responsiveness, "coordinability" or "orchestrability", self-organization, simplicity, readiness, etc.
(3) Context of action	In the context of leadership, coordination, management or direction.
(4) Organizational context	In any of these organizational contexts: teams, projects, business units, entire enterprise, or multi-organizational settings.

Thus, during the study design we had planned to contact the following "sub sample groups", depicted in **Table 5.5**, which when unified, they represent the universal set to be observed during this empirical study. Hence, we had planned to address around 800 representative agents from the phenomena in study, and we had hoped to get a response rate greater than 15%, which is considered reasonable for this type of research.

It is noteworthy that our sampling unit is the "organizational context", however this context can take many values, such as: team, projects, business units, and enterprise, or multi-

organizational settings. However, to ensure the independence of observations, each professional must answer a single questionnaire.

Table 5.5 – Survey: Sample planning. Source: Own elaboration.

ID	Sample group	Type of Sample	Weight	Sample Available	Estimated rate Target	Estimated Range (Sample Size)	Estimated Response rate	Estimated Responses
1	**SLR-AG Top Authors (from intervals 2, 3, 4, 6, 8, 9 of Figure II.3)**	Critical cases	8	**19**	80%	15	30%	4
2	**SLR-AG Authors (from 1st interval of Figure II.3)**	Typical cases	5	**327**	80%	261	15%	39
3	**Agile Governance Manifesto Signatories**	Typical cases	3, 2, 1	**48**	80%	38	15%	5
4	**MAnGve - interest list**	Typical cases	3, 2, 1	**50**	80%	40	15%	6
7	**PMI-PE list of members**	Typical cases	3, 2, 1	**485**	80%	388	15%	58
9	**Professional Social Network related to topic (ISACA, ITSMF, PMI, IEEE, ACM, etc.)**	Typical cases	3, 2, 1	*>1000*	5%	50	15%	7
					Target	**792**	**Estimated**	**119**

Finally, we can be comfortable with the amount of estimated responses to the questionnaire, i.e., $n_{estimated} = 119$, since the estimated value is greater than the minimum sample size, as depicted in **Table 5.5**. In other words, $n_{estimated} > n_{minimum}$, placing this study in the range of operational feasibility.

5.2.2 Study Development

This Section will describe the procedures related to real Explanatory Survey study, comprising: data collection, data analysis and study findings, as follows.

5.2.2.1 Data Collection

After the pilot Survey stage described in Section 5.2.1.3.1, we have refined the questionnaire for the real Survey study. **Table 5.6** depicts the structure of the version of the questionnaire applied in the survey with 41 questions, organized in two levels: (1) the lines highlithed in **bold** are categories of questions; (2) the lines highlighted in *italic* are respective subcategories.

Besides, in this table is possible to identify the interval of each category of questions by the column “Questions ID”. The entire questionnaire is available at APPENDIX VI.3.

In turn, we have applied this version of the questionnaire for 18 distinc sampling subspaces (or groups) depicted in **Table 5.7**. These sampling groups were organized based on the original planned sample groups depicted in Table 5.5 and stratified by language, which it was especially useful to plan and implement the communication plan for each group. The communication plan for every sample group comprised: invitation email, reminder emails, and last reminder email. Eventually, when some respondent has had any doubt about the questionnaire, we kept in touch individually by email, or, where required by *instant messaging tools* (e.g., Skype, GoogleTalk, etc.).

Our sampling composition has adopted a mix of **purposive sampling** types (Patton, 1990). This approach starts with a purpose in mind and the sample is thus selected to include people of interest and exclude those who do not suit the purpose. Subjects are selected because of some characteristic, (in our case, according to the subject profile depicted in Table 5.4). Purposive sampling is popular in qualitative research. We have selected some of the cases of purposive sampling proposed by Patton (1990) as follows.

Table 5.6 – Survey Questionnaire: questions profile. Source: Own elaboration.

Question profile	Questions ID	Questions Number	%
Questions about the positioning of the subject mindset	**1 - 4**	**3**	**7%**
Questions about Language	*1*	*2*	*5%*
Questions about the Organizational context	*2-4*	*3*	*7%*
Questions about constructs and their relationships	**5 - 28**	**24**	**59%**
Questions about Effects of environmental factors [E]	*5 - 9*	*5*	*12%*
Questions about Effects of moderator factors [M]	*10 - 14*	*5*	*12%*
Questions about Agile capabilities [A]	*15 - 18*	*4*	*10%*
Questions about Governance capabilities [G]	*19 - 22*	*4*	*10%*
Questions about Business operations [B]	*23 - 25*	*3*	*7%*
Questions about Value delivery [R]	*26 - 28*	*3*	*7%*
Questions related to sample qualification	**29 - 36**	**8**	**20%**
Questions about subject's qualification	*29 - 33*	*5*	*12%*
Questions about subject's organization	*34 - 36*	*3*	*7%*
Questions related to survey analysis	**37 - 39**	**3**	**7%**
Questions about agile governance adoption	*37-38*	*2*	*5%*
Questions about research contribution	*39*	*1*	*2%*
Questions related to survey feedback	**40-41**	**2**	**5%**
		41	100%

Firstly, all subjects selected to the Survey respect a predefined criteria estabilished in Table 5.4, which permit characterize the as ***criterion sampling*** that involves selecting cases that meet some predetermined criterion of importance (Patton, 2002, p. 238). Criterion sampling can be useful for identifying and understanding cases that are information rich. Criterion sampling can

provide an important qualiative component to quantitative data. Criterion sampling can be useful for identifying cases from a standardized questionnaire that might be useful for follow-up.

Table 5.7 – Survey sample: utilized sampling groups. Source: Own elaboration.

ID	Sample group	Type of Sample	Contact approach	Sample available	Subjects Invited	Partial or discarded	Completed and meeting sample criteria	Response rate	Effective response rate
1	**SLR-AG Top Authors (from intervals 2, 3, 4, 6, 8, 9 of Figure II.3)**	Critical cases	Personally	19	18	2	5	38.9%	27.8%
2	**SLR-AG Authors (from 1st interval of Figure II.3)**	Critical cases	Personally	327	241	10	10	8.3%	4.1%
3	**Agile Governance Manifesto Signatories**	Typical cases	Personally	38	38	2	9	28.9%	23.7%
4	**MAnGve.org - interest list**	Typical cases	Personally	65	65	11	6	26.2%	9.2%
5	**PMI-PE members list**	Typical cases	Personally	202	202	13	2	7.4%	1.0%
6	**Scholars and practitioners contacts (according to the profile depicted in Table 5.4)**	Typical cases	Personally	243	243	24	57	33.3%	23.5%
7	**Scholars and practitioners suggested by other respondents (according to the profile depicted in Table 5.4)**	Snowball or chain sampling	Personally	34	34	6	14	58.8%	41.2%
8	**SN01-GTI - Professional Social Network related to (Governança de TI)**	Typical cases	Social Network	1825	5	4	0	80.0%	0.0%
9	**SN03-DAD - Professional Social Network related to (DAD: Disciplined Agile Delivery)**	Typical cases	Social Network	1949	25	24	1	100.0%	4.0%
10	**SN06-ITAGG - Professional Social Network related to (ITAGG: Information Technology Audit and Governance Group)**	Typical cases	Social Network	49507	17	12	4	94.1%	23.5%
11	**SN07-ITSMF - Professional Social Network related to (ITSMF: IT Service Management Forum)**	Typical cases	Social Network	54313	9	7	2	100.0%	22.2%
12	**SN08-ISO20K - Professional Social Network related to (ITIL & ISO20000: bpcg.co.uk)**	Typical cases	Social Network	119590	26	24	2	100.0%	7.7%
13	**SN09-ITILPro - Professional Social Network related to (ITMS ITIL Professionals)**	Typical cases	Social Network	91342	20	14	5	95.0%	25.0%
14	**SN12-AG - Professional Social Network related to (Agile Governance)**	Critical cases	Social Network	65	4	3	0	75.0%	0.0%
15	***SN14-ISACA - Professional Social Network related to (ISACA Official)***	Typical cases	Social Network	23641	1	1	0	100.0%	0.0%
16	***SN15-ITGI - Professional Social Network related to (ITGI: IT Governance Institute)***	Typical cases	Social Network	962	8	6	1	87.5%	12.5%
				Total	**956**	**163**	**118**	**29.4%**	**12.3%**

Critical case sampling is the process of selecting a small number of important cases - cases that are likely to "*yield the most information and have the greatest impact on the development of knowledge*" (Patton, 2002, p. 236). The sample group "Top Authors" identified by the systematic review described in Section 2.4.1 was considered critical case sampling because its members are the scholars and practitioners who have developed and applied knowledge about agile governance around the world. Although sampling for one or more critical cases may not yield findings that are broadly generalisible they may allow researchers to develop logical generalizations from the rich evidence produced when studying a few cases in depth.

Typical case sampling is a type of purposeful sampling in which, "*subjects are selected who are likely to behave as most of their counterparts would*" (McDonald, 2007). For example, the subjects from the sample group "Agile Governance Manifesto Signatories" have a profile like that of the larger population of interest and because of that they can be considered representative agent of the phenomena in study.

We also have adopted ***snowball or chain sampling*** that involves using well informed people to identify critical cases - informants who have a great deal of information about a phenomenon. The researcher follows this chain of contacts in order to identify and accumulate critical cases. This method can be useful for identifying a small number of key cases that are identified by a number of key or expert informants as important cases or exemplars. We have asked to the subjects who have participated of the Survey, if they could suggest other respondents who suit the required profile and could contribute with the ongoing survey. When they sent to us the personal data of pretense subjects, we had analyzed the profile: sometimes we looked for previous publication (if they are scholars), curriculum vitae or professional profile on the web. As a result we decided if they really have suited the required profile, and when they matched we made a contact and/or sent an invitation to participate in the Survey. The column "Type of sample" from **Table 5.7**, characterizes the classification for each sample group.

One of the many forms for analyze this universe sample is categorize the groups based on the "**Contact approach**" adopted for each sampling group. For the sampling groups from 1 to 7 depicted in **Table 5.7**, we have contacted personally each member, inviting them to participate in the study, by email. Hence, we have addressed personally 841 representative agents from the phenomena in study, and we had a **response rate** around 20.3% (obtained by the ratio of 171 responses out of 841 invitations), as well as an **effective response rate** around 12.2%

(obtained by the ratio of 103 responses completed that met the sample criteria, out of 841 invitations sent), which is considered reasonable for this type of research, considering the heterogeneity of our universal sampling (Sheehan, 2001).

For the sampling groups from 8 to 16 depicted in **Table 5.7**, we have invited the members from closed Professional Social Network groups to participate in the study, by means of the creation of a personalized URL for each group, warning members do not share these URLs outside the groups. Hence, we have addressed 115 representative agents[68] from the phenomena in study, and we had a **response rate** around 95.7% (obtained by the ratio of 110 responses out of 115 invitations), as well as an **effective response rate** around 13.0% (obtained by the ratio of 15 responses completed that met the sample criteria, out of 115 invitations sent), which is considered reasonable for this type of research, considering the specificity of our survey (Baruch and Holtom, 2008).

Although we do not have performed observation in the (15) SN14-ISACA and (16) SN15-ITGI groups depicted in **Table 5.7**, we have decided to include them in the Survey process, due to their relevance to the topic under discussion. We had some difficulty in communicating with members of these groups for two reasons: (1) we had no prior knowledge about which were the most participatory members because we had no interacted with the group before, so, we had to choose them randomly; (2) all posting in the group goes through a "moderation" and is not immediately available for members, because of that we had some delay in communication[69]. These aspects visibly have impacted in the contribution of these groups to the Survey results, as depicted in **Table 5.7**, reflecting in low effective response rates.

Thus, we have contacted the "sample groups" depicted in **Table 5.7**, which when they were unified, they represent the universe of the survey observed during this empirical study. A total of 281 questionnaires were answered by the representative agents of the phenomena in study (representing a global ***response rate*** around 29.4%), but of these only 118 were considered valid for the phase of interpretation, and analysis of data (representing a global ***effective response rate*** over 12.3%). In fact, according to the Survey protocol, 163 cases were discarded because they did not fully met the criteria established for research (see profile depicted in **Table 5.4**). One of the discard criteria most frequently occurring was the partial or incomplete

[68] Those most participatory members identified, in the most active groups, during the Observation on professional groups based on Social Networks, at stage 2 of the research framework depicted in Figure 2.1.

[69] This second reason was the argument why we did not include these two groups in stage 2 of this research.

filling of the questionnaires. Thus, the total useful sample for this study was composed of 118 elements ($n = 118$), representing a statistically significant sample, since it took at least 105 respondents according to the classical sampling theory (Gil, 2009) and more than 100 cases, according to chosen method (SME) (Westland, 2010). The **response rate** can be considered an indicator to measure amplitude of the *study range efficiency* over the sampling universe (Baruch, 1999). On the other hand, the **effective response rate** is an indicator of the *data collection efficiency*, because it describes the useful sample (set of responses) that will be considered to the Survey analysis that follows.

From this Section we will be considering in our discussions only the ***set of effective responses*** from the survey for the analysis that follows ($n = 118$). Based on these results, we can conclude that the Survey data collection parameters fit into the range established by the study design (see Section 5.2.1), as follows:

(1): **Survey real sample size (n_{survey}, or simply n):** indicates the sample statistics significance, as demonstrated below (see further details in Section 5.2.1.4).

a. $n_{survey} = 118 \therefore n_{survey} > n_{Sampling\ theory} > n_{SEM}$

(2): **Survey confidence level (σ^2)**: 99.7% (corresponding to three standard deviations).

(3): **Survey maximum error allowed (e^2)**: 5.0%.

Further details about Survey data collection are available in APPENDIX VI.

5.2.2.2 Sample Analysis

Other form to analyze the Survey sample **($n_{survey} = n = 118$)** can be by means of comparison of the contribution from each group sample as depicted in **Figure 5.5**. This figure denotes in its part (A) the total contribution of each sampling group from the **Table 5.7,** where, just for the sake of simplification, we have decided to group the responses from sampling groups 8 to 16 in a single slice of the pie, namely “Social Professional Network”. In turn, these groups have their contributions detailed in the part (B) of the same figure.

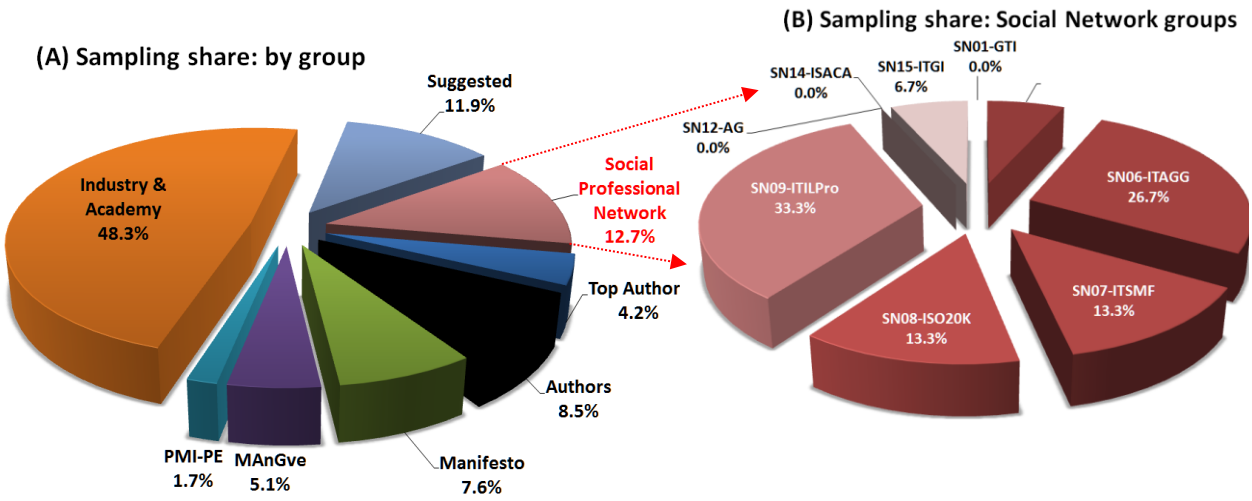


Figure 5.5 – Survey sampling share: by group ($n = 118$). Source: Own elaboration.

Figure 5.5 demonstrates that the most representative sampling groups were "**Industry & Academy**", which comprises scholars and practitioners according to the required profile depicted in **Table 5.4**; followed by "**Suggested**", which holds scholars and practitioners suggested by other respondents (according to the same profile); and "**Agile governance Authors**", which encompasses the "Top Authors" and "Authors" identified by our systematic review described in Section 2.4.1.

Regarding to the "**Contact approach**" the large amount of respondents were contacted personally in opposite to the indirect contact, by means of the Social Professional Networks, as depicted in **Figure 5.6**.

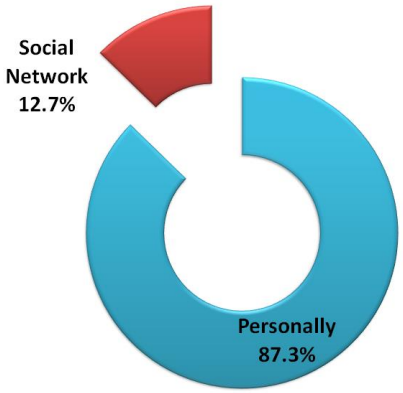


Figure 5.6 – Survey sampling share: by contact approach ($n = 118$). Source: Own elaboration.

We can also analyze the sample by the purposive sampling types according to (Patton, 1990), as depicted in **Figure 5.7**. The most representative sample type was "**Typical cases**", which allow us to understand the responses profile obtained as "*what is agreed as average, or normal*" arising out of the representative agents from the phenomena in study. This sample representativeness means that we can compare the findings from this study using typical case sampling with other similar samples (i.e., comparing samples, but not generalizing a sample to a

population). Therefore, with typical case sampling, we cannot use the sample to make generalizations to a population, but the sample could be illustrative of other similar samples. According to (Patton, 1990), while typical case sampling can be used exclusively, it may also follow another type of purposive sampling technique, such as "**Snowball or chain sampling**" and "**Critical cases**".

This prior one is the second most representative purposive sampling type found in our study. When we realized that the "**Snowball**" also went through the process of analyzing whether every suggestion (respondent candidate) has matched with the same profile (**Table 5.4**) adopted to choose the "Typical Cases", we can either consider the "Snowball" sampling as "Typical case". Hence, we can infer that the "Typical cases" represents around 87.3% from the purposive sampling types found in our Survey study.

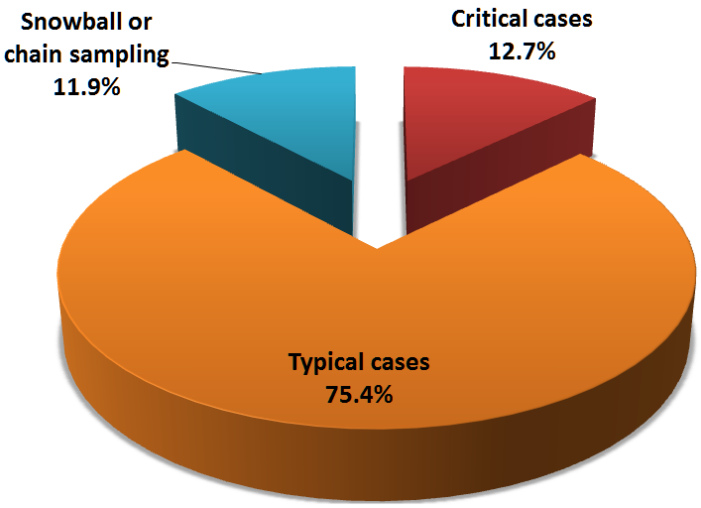


Figure 5.7 – Survey sampling share: purposive sampling types ($n = 118$). Source: Own elaboration.

Finally, the "**Critical cases**" was the third most representative sampling type found in this study. Although sampling for one or more critical cases may not yield findings that are broadly generalizable they may allow us to develop logical generalizations from the rich evidence produced when studying a few cases in depth. This approach permits logical generalization and maximum application of information to other similar cases because whether the responses profile is true of this once case, it is likely to be true of all other cases. However, the representativeness of this sampling type is small to allow us any kind of logical generalization from the findings. This later group can be considered the group comprising the *top experts* in the phenomena under study, and represent 12.7% of our survey sample.

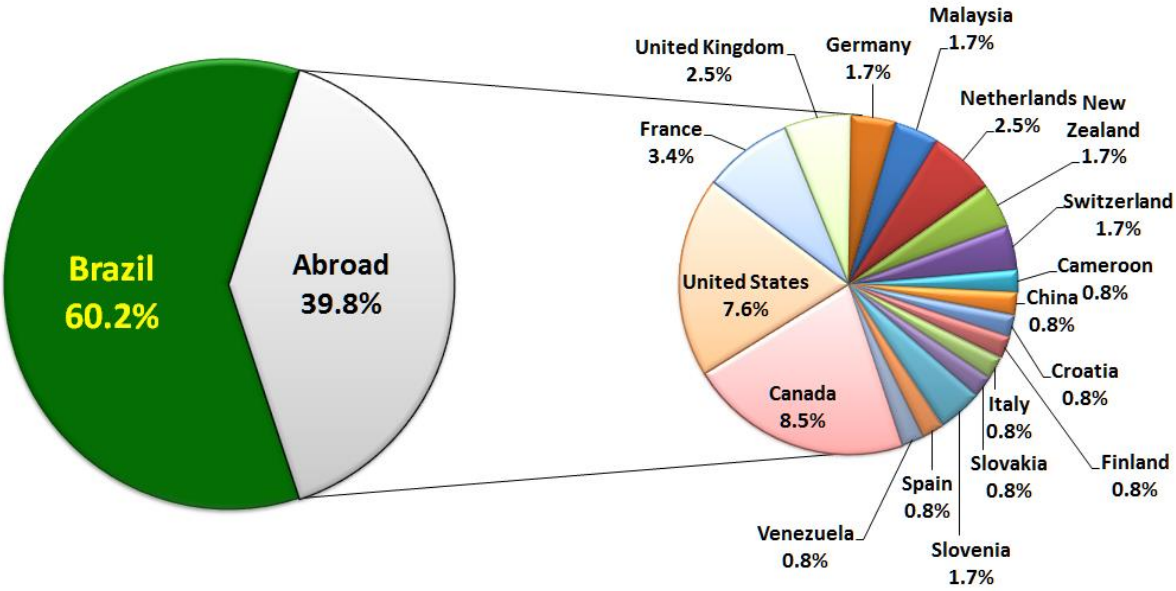


Figure 5.8 – Survey sampling share: by country ($n = 118$). Source: Own elaboration.

In relation to geographical location of each respondent, based on the Internet Protocol (IP) collected during the questionnaire fulfilment, we can identify the sample share by country as depicted in **Figure 5.8**. Around 39.8% of the sample was located abroad, in distinct countries covering five continents as depicted in **Figure 5.9**. This information gives us an overview of the geographical coverage of the study.

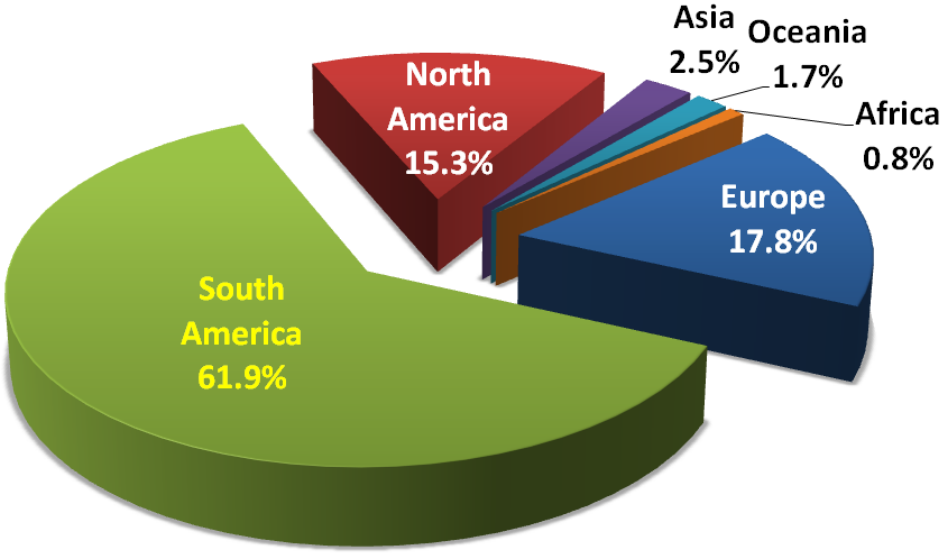


Figure 5.9 – Survey sampling share: by continent ($n = 118$). Source: Own elaboration.

Concerning to "Work experience" (Q29[70]) around 72.9% of the respondents from the sample have *more than 11 years*, and 40.7% have *more than 20 years* of professional experience. In complement, about 54.2% of the respondents have *more than 6 years* of "Governance

[70] This notation indicates that we are addressing the answers' consolidation from the Question 29 of the Survey questionnaire, available at APPENDIX VI.3.

experience" (Q32), while over 37.3% of them have *more than 6 years* of "Agile/Lean experience" (Q33). They mostly (55.9%) work in large "Organization size" (Q34), which have multinational or global "Operating scale" (Q36) in 24.6% of the cases, on a wide spectrum of "Economy sectors" (Q35), of which stands out *IT industry* (42.4%). Some of them even have *prominent leading* "Job positions" (Q30) in their organizations, as *CEO, CIO or Business Owner* (13.6%).

This information matches the planned profile established in study design, qualifies properly the Survey sample, and characterizes the respondent profile for the discussion that follows in coming Sections about Survey findings. Details about the sample qualification are available at APPENDIX VI.4.

5.2.3 Data analysis and findings

From the sample obtained by applying the questionnaire, this Section presents the statistical analysis procedures required for assessment of the study hypotheses and the interpretation of results. We have used the softwares *IBM® SPSS® Statistics 20.0* and *IBM® SPSS® Amos 20.0*. Firstly, we characterize the mindset of the respondents in terms of organizational context chosen and self assessment about a scale from chaos to order. Next, the validation of a set of assumptions is performed to verify the plausibility of applying *Structural Equation Modeling (SEM)* to the data of this research. Sequentially, we present the *Exploratory Factor Analysis (EFA)* of the six latent variables of the theoretical model in order to find the best subset of factors and indicators that give a great combination of parsimony and quality of model adjustment. Subsequently, the SEM modeling is conducted in two stages: i) applying the *Confirmatory Factor Analysis (CFA)* to assess the quality of the measurement sub-model of adjustment; and ii) examining the complete structural equation model (measurement sub-model + structural sub-model). Finally, we present the results of SEM analysis, which allow accept or refute the assumptions made in the theoretical model and interpret the phenomenon under study.

5.2.3.1 Subjects' mindset and experience: context, attitudes and beliefs

Mindset is a habitual or characteristic *mental attitude* that determines how people will interpret and respond to situations, i. e., a complex mental state involving beliefs and feelings and values and dispositions to act in certain ways.

A closer look at these aspects is necessary, once the emerging theory handles with the environment comprised by the influence of social, economic, cultural, technological and political aspects related to positions and roles on individuals of a group, and refers to the scope of an institution; insofar this *organizational context* can be, in increasing order of complexity: team, project, business unit, enterprise, or a multi-organizational setting.

In our survey two questions were related directly to the respondent's mindset: (i) what is the **organizational context** chosen as a background to answer the questionnaire (Q2); and, (ii) a self assessment about how the chosen context could be evaluated in terms of **chaos and order** (Q4).

In the second question (Q2) we ask to the subjects to keep in mind only a *unique organizational context* when they were answering the questionnaire, aiming to help them to estabilish a referencial to interpret and answer each question, in order to minimize any misunderstanding, at same time to avoid biases during our data analysis. The answers profile is depicted in **Figure 5.10**. The most representative organizational context chosen to answer the questionnaire were "Enterprise" and "Project", followed closely by "Business unit" and "Teamwork". The less representative context was "Multiorganizational".

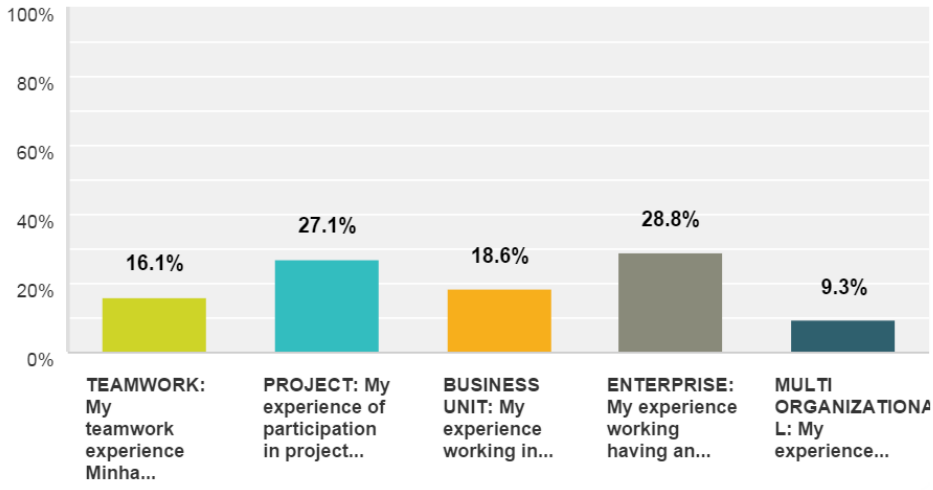


Figure 5.10 – (Q2) Organzational context: answers profile ($n = 118$). Source: Own elaboration.

Considering the theory premises discussed in Section 4.2.2 (based on the findings of our systematic review discussed in Section 3.7.10), at the fourth question (Q4) we ask to the subject to better characterize the chosen organizational context in a scale from chaos to order depicted in **Figure 5.11**.

Criteria	Assessment scale									
Illustrative Legend	Chamos: destructive chaos		Chaos		Chaordic: a mix of chaos and order		Order		Control and rigidity	
Numeric Scale	1	2	3	4	5	6	7	8	9	10
Your answer: how do you better characterize the chosen organizational context (our analysis unit) regarding to chaos and order?	Collapsing disorder and confusion	Destructive disorder and confusion	Complete disorder and confusion	Disorder and confusion	Blends more features of chaos than order	Blends more features of order than chaos	Procedures established	Adoption of best practices	Control and rigidity	Oppressive control and rigidity

Figure 5.11 – Chaos & Order: assessment scale. Source: Own elaboration.

When we connect the answers from Q2 with the data gathered from Q4 we have an emerging pattern of the mindset related to chaos and order from each type of organizational context related to this survey. **Figure 5.12** depicts this crossing check information between Q2 and Q4 data, presenting the *minimum* value (-), *maximum* vaue (+) and *mean* ($\bar{x}$) for each context analysis.

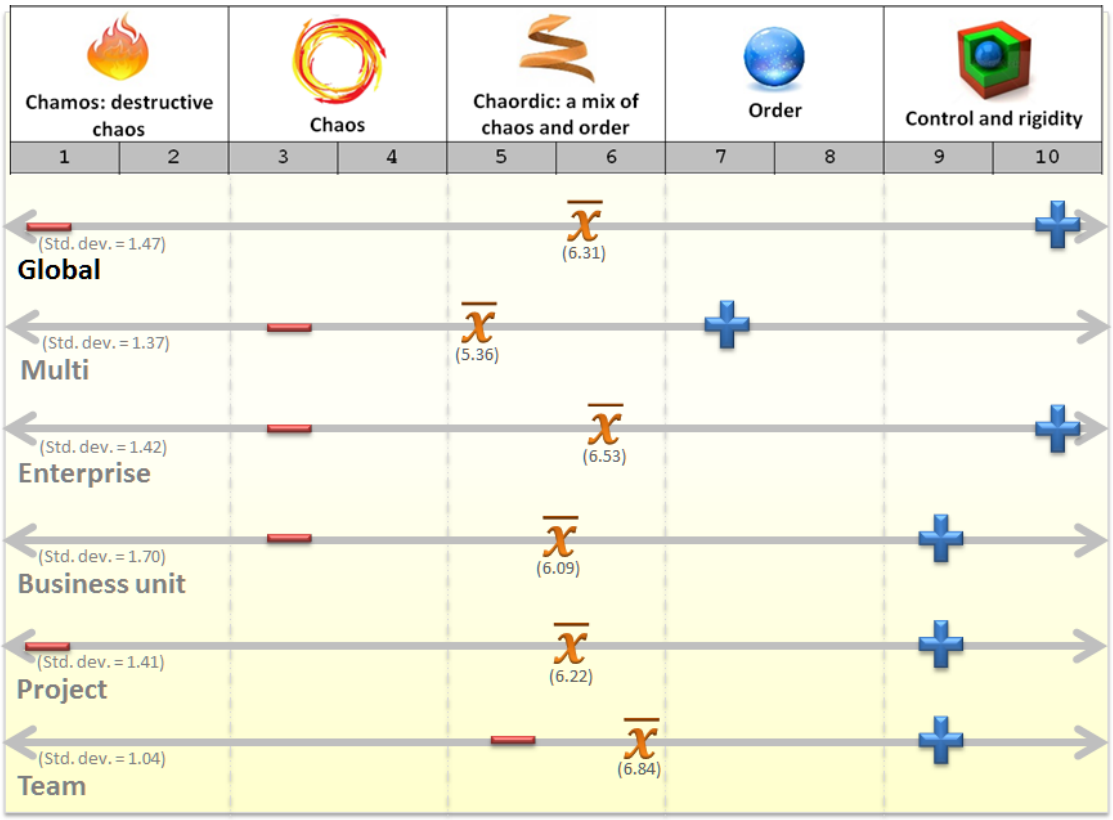


Figure 5.12 – Chaos & Order: by organizational context ($n = 118$). Source: Own elaboration.

Based on the analysis of the **Figure 5.12**, we can infer that in a broad sense, doing a **global** analysis, the organizational contexts used as reference to answer the questionnaire has a wide spectrum of classification according to chaos and order, having its *mean* value around 6.31 in the chaos and order scale, i.e., into a scale *chaordic range*. In addition, the Survey sample has showed wide amplitude between the 1 and 10, covering the entire scale spectrum. In fact, every organizational context from this sample matches their *mean* value into a *chaordic range of the chaos scale*, as the theory's premises suggest. Despite we cannot generalize this finding (both because the sampling nature already discussed in Sections 5.2.2.1 and 5.2.2.2, as well as due the mean value is not enough statistical indicator to this inference), we can understand this evidence as a demonstration of the plausibility of the theory's assumption as well as a *symptom* that needs to be further studied in future work.

The **multiorganizational context** seems the most chaotic environment presenting a mean about 5.26 (the nearest from scale *chaotic range*), and having its results concentrated in the interval between 3 and 7. On the other hand, **teamwork context** has presented the mean value (6.84) closest by from the scale *order range*, varying its values between 5 and 9. From the organizational contexts surveyed by our study, **project context** showed the greater amplitude of results between 1 and 9, as well as a mean over 6.22. This result probably indicates a broad nature (heterogeneity) of distinct projects that were considered to answer this survey, leading us to believe that can be a relevant topic for further investigation. **Enterprise** and **business unit contexts** have depicted a quite similar results profile about chaos and order, having the same minimum value (3) and a little different maximum value: 9 for business unit, and 10 for enterprise. The mean value of 6.53 and a maximum value about 10 for **enterprise context**, against a mean value around 6.09 and a maximum value of 9 for **business unit context**, suggest enterprise as more rigid, and less receptive, to changes environment than business unit. These patterns are not generalizable due the matters discussed in Sections 5.2.2.1 and 5.2.2.2, but allow us to get the best out from collected data for analysis that follows.

Other relevant aspect that we have to consider regards to: governance and agile experiences. Indeed, beyond the assessment of total work experience time (Q29), the experience of the respondents was assessed for how long they have been participating or involved directly or indirectly, both: (1) in initiatives to support governance (Q32); and, (2) using lean or agile mindset (principles, values, practices, etc.) (Q33). As already discussed, around 72.9% of the respondents from the sample have *more than 11 years*, and 40.7% have *more than 20 years* of

professional experience. In addition, about 54.2% of the respondents have *more than 6 years* of "Governance experience" (Q32), while over 37.3% of them have *more than 6 years* of "Agile/Lean experience" (Q33). These experience time on those issues are relevant enough when we address aspects of agility in governance matters, as a young and nascent eight years old area, considering the publication of the first definition of agile governance by Qumer (2007) [S54].

In other words, these professionals have the knowledge and the experience required to properly inform about the various characteristics measured in the survey. Further detail about the sample qualification are available at APPENDIX VI.4. These dimensions constitute control variables to assess the quality of the answers collected through the survey instrument: (1) mindset; and, (2) subject experience.

5.2.3.2 Verification of the assumptions for application of multivariate analysis

Before using multivariate techniques which make up the modeling structural equation for the treatment of research data, we should proceed with the verification of a set of assumptions, whose transgression seriously undermines the process of calculation and the results and conclusions of the analysis. The related assumptions that must be verified are: (1) Independence of observations; (2) Scale recoding and treatment of missing values; (3) Internal consistency of the measuring instrument; (4) Univariate and multivariate normality; (5) Nonzero sample covariance; (6) Multicollinearity absence; and, (7) Absence of non-standard values (outliers). The full analysis of these assumptions are detailed in APPENDIX VII.1.

The evaluation of the assumptions is then a first key step in the SEM modeling to avoid biased results. Thus, this Section analyzes the independence of observations, the recoding of the scales and treatment of missing data (*missing values*), the reliability and validity of the measuring instrument. Additionally, we verify the univariate and multivariate normality, the existence of linearity of the relationship, the presence of non-zero sample covariance, the absence of multicollinearity and the absence of extreme values (*outliers*).

Due to the **theory general model** based on the **Dynamic scenario (φ_n)**, depicted in **Figure 5.2**, does not having *exogenous variables* (independent), we will adopt the model depicted in **Figure**

5.13 based on the **Startup scenario (φ_4)**, as simplification of the model from **Figure 5.2**, to proceed the following checking topics. This choice is because, even when we analyze other scenarios from theory that have *exogenous variables* (independent), such as **Begginers scenario (φ_0)**, **Governance Experience Scenario (φ_1)**, **Agile or Lean Experience Scenario (φ_2)**, or **Dissociative Scenario (φ_3)**; we can observe that **Startup scenario (φ_4)** is the most complete of them, as well as, in all of them only the construct *Effects of environmental factors* [E] behaves as *exogenous variables* (independent).

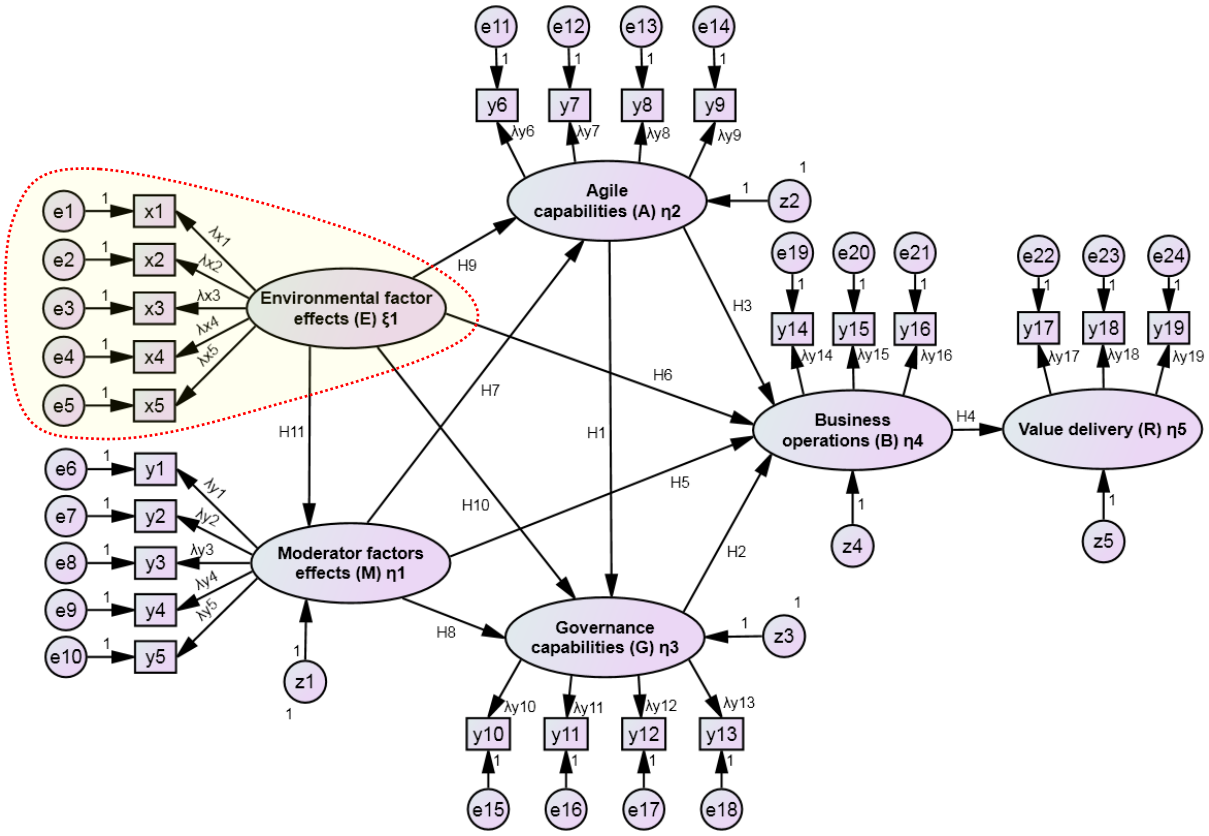


Figure 5.13 – Theoretical model of structural equations of the factors affecting the agile governance: theory general model based on Startup Scenario (φ_4). Source: Own elaboration.

After develop analysis for each of those assumption in APPENDIX VII.1, we can conclude that there is not any transgression that can seriously undermine the process of calculation and the results and conclusions of the analysis that follows.

5.2.4 Exploratory Factor Analysis (EFA)

The *Exploratory Factor Analysis (EFA)* is one of the most powerful methods to reduce the complexity of a set of variables seeking to facilitate a deeper statistical view of the data and their correlations. The EFA analysis allows "identify" the latent structure of a mass of data

analyzing the presence of a number of factors (or underlying dimensions) to explain why some of the variables are correlated, while others do not.

Although, EFA is theoretically used when the researcher do not know *a priori* the latent structure of the data, in practice usually, the researcher is guided by some prior theoretical knowledge. In this sense, as suggests by Izenman (2008), no factor analysis is completely exploratory. In this study, we are being guided by the emerging theory described in Chapter 4. However, we are using EFA to study the structures underlying the manifest variables and their relationship with the six latent variables of the theoretical model derived from that emerging theory.

The analysis was performed using software *IBM® SPSS® Statistics* 20.0, and adopting the method of principal components, with the criterion of self-worth (Eigenvalue ≥ 1) to extract the appropriate number of factors. We have used the orthogonal *Varimax* rotation method seeking only significant weights in the principal component, and weights close to zero in the other components, in order to minimize the number of variables in each group, making easy the interpretation of results.

Following the recommendations of Hair et al. (2009) and Izenman (2008), the parameters analyzed were: i) the factor loadings; ii) commonalities of each variable; iii) the Kaiser-Meyer-Olkin (KMO) test as sample adequacy measure (*Measure of Sampling Adequacy-MSA*); iv) the Bartlett sphericity test; v) the percentage of the accumulated variance of the variables to the latent factor generated. These criteria, with their recommended values are given in **Table 5.8**.

Table 5.8 – Values adopted as evaluation criteria in EFA. Source: Hair et al. (2009) and Izenman (2008).

Statistical tests and measures	Suggested values
Factor loadings	≥ 0.30
Commonalities	≥ 0.50
KMO (*Measure of Sampling Adequacy-MSA*)	≥ 0.50
Probability associated with the Bartlett test	< 0.001
Percentage of the accumulated variance	$\geq 60\%$

Additionally, we have performed the analysis of the anti-image correlation matrix to verify the adequacy of the sample measured for each variable. All diagonal elements of this matrix must be greater than 0.5 to justify their retention in the analysis.

In the following section we will carry out a detailed discussion about the EFA analysis on the construct: Effects of environmental factors [E]. However, as a matter of objectivity, we will provide the detailed EFA analysis to the remaining five constructs in the APPENDIX VII.1.

5.2.4.1 EFA for Effects of environmental factors [E]

Following the recomendations mentioned at the beggining of the Section 5.2.4, the EFA for the variable ***Effects of environmental factors [E]*** was performed with the five manifest exogenous variables from the model depicted in **Figure 5.13**, i.e., x_1, x_2, x_3, x_4, and x_5.

Table 5.9 – KMO and Bartlett's Test: for [E]. Source: Own elaboration from SPSS.

Statistical tests and measures		Calculated values
KMO (Measure of Sampling Adequacy-MSA)		0.728
Bartlett's Test of Sphericity	Approx. Chi-Square	114.057
	Degrees of freedom (df)	10
	Significance	0.000

The first results analyzed are depicted in **Table 5.9**, which sets out the *KMO* (*Measure of Sampling Adequacy-MSA*) with acceptable value of $0.728 > 0.5$; i.e., this test indicates that the variables are related, and therefore the use of factor analysis makes sense.

Moreover, *Bartlett's Test of Sphericity* is based on the statistical distribution of chi-square (χ^2), and it tests the null hypothesis that the *correlation matrix* is an *Identity Matrix* (which contains the diagonal elements of value 1, and other elements are zero), i.e., there is no correlation among variables. Thus, for a *significance* level of less than 0.001, as depicted in **Table 5.9**, we can accept the null hypothesis that the random sample comes from a population in which the variables are not completely correlated.

Furthermore, from **Table 5.10**, we can observe that the diagonal elements of the *anti-image matrix* are greater than 0.5, representing values *Measure of Sampling Adequacy - MSA*, supporting their retaining in our analysis.

Table 5.10 – Anti-image Correlation Matrix: for [E]. Source: Own elaboration from SPSS.

	x_1	x_2	x_3	x_4	x_5
x_1	**0.694**[a]	-0.334	0.137	-0.259	-0.287
x_2	-0.334	**0.736**[a]	-0.228	-0.062	-0.071
x_3	0.137	-0.228	**0.644**[a]	-0.162	-0.117
x_4	-0.259	-0.062	-0.162	**0.762**[a]	-0.301
x_5	-0.287	-0.071	-0.117	-0.301	**0.761**[a]

a. Measures of Sampling Adequacy (MSA)

Then, using the *Principal Component Analysis* extraction method, the commonality of each variable was assessed as depicted in **Table 5.11**. These values indicate the amount of variance explained by the factors common to these variables, i.e., the proportion of variance from the original variables (from x_1 to x_5) assigned to the factor in analysis: [E]. Usually, it is assumed that a factor should explain at least half of the variance for each original variable ($\text{communality} \geq 0.50$).

Table 5.11 – Communalities: for [E]. Source: Own elaboration from SPSS.

Meaning	Variable	Communalities
Technology	x_1	0.573
Regulatory institutions	x_2	***0.469***
Competitiveness	x_3	***0.203***
Economy	x_4	0.565
Turbulence	x_5	0.570

In this case, there is a very small communality (0.203) for the variable x_3, so the common factor does not adequately explain the variance of this item. The variable x_3 was considered in the model to measure the influence of the "***competitiveness***" upon the organizational context, as a measure to understand the *Effects of environmental factors* [E].

In spite of "competitiveness" be a variable widely supported by the technical and scientific literature as a strong influencing factor on the organizational context (especially in dynamic and turbulent environments), it is a surprise does not find statistical support in this quantitative study. We can infer that the result found here reflects the difficulties of people, who working in the most inner layers of the organization (organizational contexts such as: team, projects and business units), have to realize the "competitiveness" as a factor that influences their own context.

Based on the comments left on the question Q7 from the questionnaire, the most part of them just realize "competitiveness" as an influencing factor of [E], when they are handling with aspects related to business market (i.e., organizational contexts such as: enterprise and multiorganizational settings). Mainly, this kind of perception was quite common for respondents who indicated are working in public administration and services related to government (question Q35), which was the third most often mentioned economy sector, represented by 19.49% from the data sample.

Further, x_2 also presents communality (0.469) below 0.5. The variable x_2 was considered in the model to measure the influence of the "***regulatory institutions***" upon the organizational context, as a measure to understand the *Effects of environmental factors* [E].

Based on the comments received on the question Q7 from the questionnaire, we can also imply this result as a *mindset effect* related to the organizational context. In this sense people who work in enterprise and multiorganizational contexts can realize easily the effect caused by “government role” or “regulatory agencies”. Whereas, people who work in teams, projects, or even business units; have greater difficulty in seeing “quality assurance role” or “systems auditing” as an effect of "***regulatory institutions***". As a learned lesson, these findings strongly suggest that we must develop distinct questionnaires, adopting distinct group of empirical indicators (contextualized) for each organizational context, in future studies, in order to avoid this type of bias.

Considering these arguments, it was understood that the variables x_2 and x_3 should be removed from the analysis because the common factor does not adequately explain the variance of these items. After this modification, was conducted again the EFA to construct [E], with three manifest variables (x_1, x_4, and x_5).

Table 5.12 presents the new KMO values and the Bartlett test depicting the appropriateness of factor analysis to the data sample.

Table 5.12 – KMO and Bartlett's Test: for [E], after removing of $\boldsymbol{x_2}$ and $\boldsymbol{x_3}$. Source: Own elaboration from SPSS.

Statistical tests and measures		Calculated values
KMO (Measure of Sampling Adequacy-MSA)		0.682
Bartlett's Test of Sphericity	Approx. Chi-Square	69.521
	Degrees of freedom (df)	3
	Significance	0.000

Table 5.13 depicts the *anti-image matrix* with all elements of the main diagonal greater than 0.50.

Table 5.13 – Anti-image Correlation Matrix: for [E], after removing of $\boldsymbol{x_2}$ and $\boldsymbol{x_3}$. Source: Own elaboration from SPSS.

	$\boldsymbol{x_1}$	$\boldsymbol{x_4}$	$\boldsymbol{x_5}$
$\boldsymbol{x_1}$	0.692[a]	-0.291	-0.325
$\boldsymbol{x_4}$	-0.291	0.685[a]	-0.341
$\boldsymbol{x_5}$	-0.325	-0.341	0.672[a]

a. Measures of Sampling Adequacy (MSA)

After adjustments, all commonalities from **Table 5.14** are greater than 0.50, indicating that much of the variance of the manifest items is explained by the [E] factor.

Table 5.14 – Communalities: for [E], after removing of $\mathbf{x_2}$ and $\mathbf{x_3}$. Source: Own elaboration from SPSS.

Meaning	Variable	Communalities
Technology	x_1	0.634
Economy	x_4	0.643
Turbulence	x_5	0.660

According to **Table 5.15**, there is a unique eigenvalue (*Eigenvalue*) greater than 1. Thus, by the latent root criterion, to derive the number of factors, there is a single component to be extracted for these variables.

Table 5.15 – Total Variance Explained for [E], from the extracted components (after removing of x_2 and x_3). Source: Own elaboration from SPSS.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.937	64.558	64.558	1.937	64.558	***64.558***
2	0.549	18.296	82.853			
3	0.514	17.147	100.000			

Extraction Method: Principal Component Analysis.

Furthermore, the *cumulative proportion of explained variance* ($\geq 60\%$) is satisfied with one component, that is, the solution proposed by *IBM® Statistics SPSS* 20.0 software could explain 64.558% of the total variance. This result can be also displayed graphically in **Figure 5.14**.

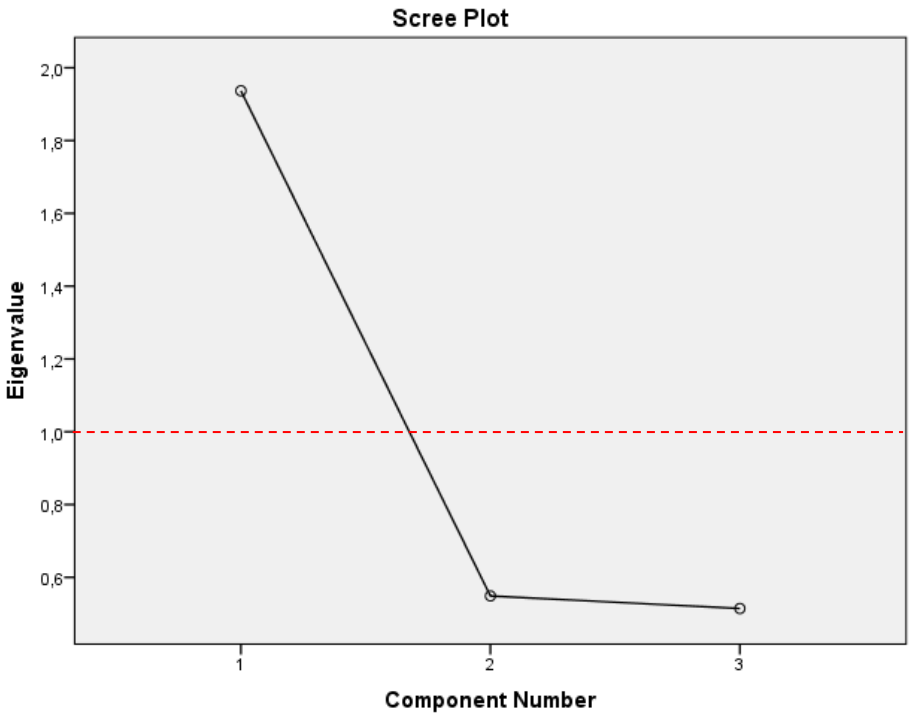


Figure 5.14 – Eigenvalues as a function of the number of components for latent variable [E]. Source: Own elaboration from SPSS.

Finally, **Table 5.16** depicts the factor loadings for each variable. In this case only one component was extracted, and therefore, the solution cannot be rotated.

Table 5.16 – Component Matrix: for [E], after removing of x_2 and x_3. Source: Own elaboration from SPSS.

	Component 1[a]
x_1	0.796
x_4	0.802
x_5	0.813

[a.] 1 component extracted.

As a consequence, the results of the EFA reported in this Section, to the construct ***Effects of environmental factors [E]***, will be later incorporated into the redesign of the complete theoretical model.

For each *latent variable* (construct) of the model derived from the emerging theory depicted in Chapter 4, we have followed the same procedure. Complete details about EFA analysis from every remaining construct are available at: APPENDIX VII.1.

5.2.4.2 EFA for constructs: final remarks

During the EFA analysis, four *manifest variables* were eliminated (x_2, x_3, y_2, and y_{13}), due to reduced commonalities. All the adjustements performed were properly supported by theory, related works and evidences gathered during the development of this research (see details in APPENDIX VII.1).

After those adjustments, we are able to understand and *confirm the plausibility* of the structures underlying the manifest variables and their relationship with the six latent variables of the theoretical model derived from that emerging theory.

5.2.4.3 Model adjustments based on Exploratory Factor Analysis (EFA)

Following the recommendations of the EFA, four *manifest variables* were eliminated (x_2, x_3, y_2, and y_{13}), due to reduced commonalities. With these changes, the original model depicted in **Figure 5.13** has become simpler as portrayed in **Figure 5.15**.

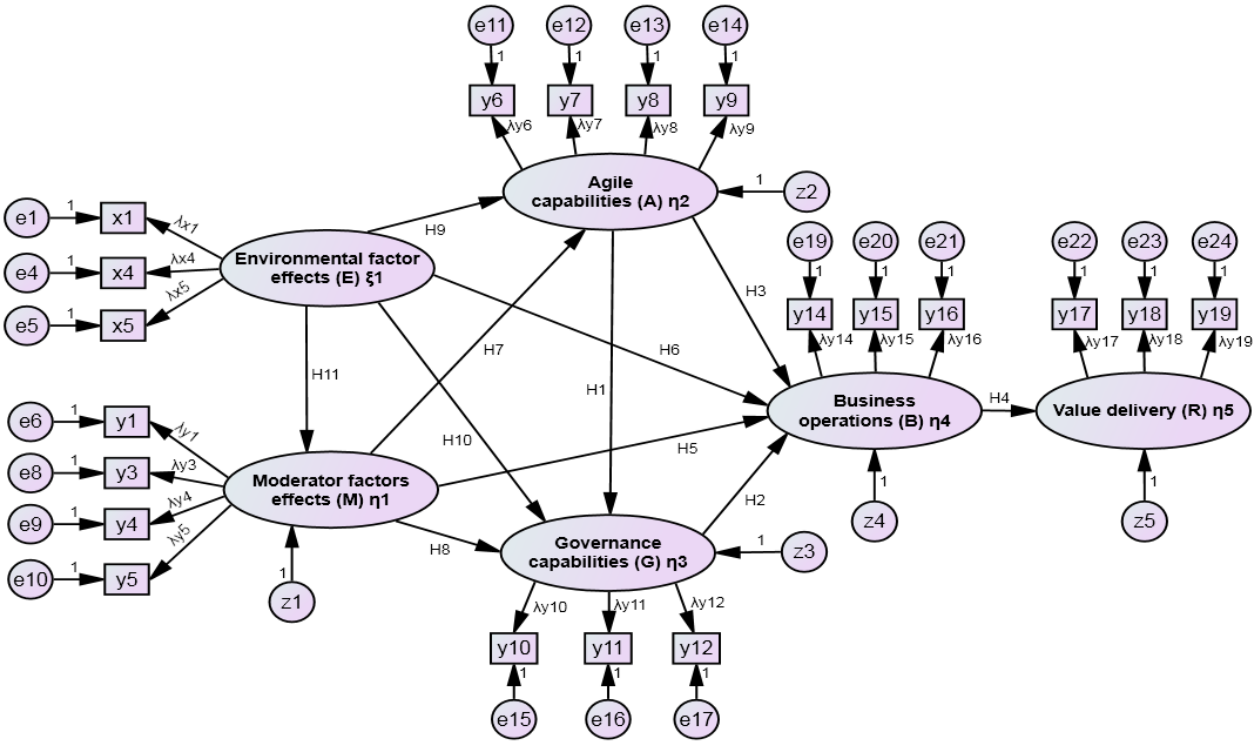


Figure 5.15 – Theoretical model of structural equations of the factors affecting the agile governance: theory general model based on Startup Scenario (φ_4), adjusted after EFA. Source: Own elaboration.

In this version of theory general model based on Startup Scenario (φ_4), which was adjusted after EFA, there is **one** *exogenous variable* (independent): ***Effects of environmental factors*** **[E] (ξ_1)**, operationalized by **three** *manifest variables* (x_1, x_4, and x_5). Also, there are **five** *endogenous variables* (dependent): ***Effects of moderator factors*** **[M] (η_1)** whose set of measurement is formed **four** *indicators* (y_1, y_3, y_4, and y_5); ***Agile capabilities*** **[A] (η_2)**, operationalized by **four** *manifest variables* (y_6, y_7, y_8, and y_9); ***Governance capabilities*** **[G] (η_3)**, measured by **three** *manifest variables* (y_{10}, y_{11}, and y_{12}); ***Business operations*** **[B] (η_4)**, operationalized by **three** *manifest variables* (y_{14}, y_{15}, and y_{16}); and, ***Value delivery*** **[R] (η_5)** measured by **three** *manifest variables* (y_{17}, y_{18}, and y_{19}).

The **error terms** of the *independent variables* would be represented by **δ**, while the error associated with each *dependent variable* is represented by **ε**; both δ and ε represent the *part not explained by the factor* (construct) the *variable manifest* and which would be explained thus *by other factors* (variables) *not considered in the model*. Similarly, *endogenous latent variables*, η_1 to η_5, have their causes in their relations, and the unexplained part is attributable to the **error** or disturbance ***z***. The factorial weights represented in the model by the Greek letter *lambda* (λ), and the structural coefficients characterized by the hypotheses (H), are depicted in order of cause and effect.

5.2.5 Structural Equation Modeling (SEM)

The SEM model in **Figure 5.13**, proposed based on the emerging theory depicted in Chapter 4, was modified on the basis of Exploratory Factor Analysis (EFA), generating the model portrayed in **Figure 5.15**.

This stage of the study analysis is about the transition from exploratory analysis, in which the researcher does not control the variables that describe each factor, to a confirmation stage, where the researcher specifies the indicators for each construct (factor). The data collected from respondents are "empirical indicators" or manifest variables of the measurement model and they are used to measure the latent constructs. In this Section, we will carry out the following methodological steps: i) identification of model; ii) estimation of parameters; iii) assessment of the adjustment factors; and iv) modification of the model, if necessary, in order to proceed the validation the hypotheses and interpret the results.

In order to test the proposed hypotheses about the emerging Agile Governance Theory, we adopted the *Structural Equation Modeling (SEM)* by means of application of *IBM® SPSS® Amos 20.0* software, using the *Maximum Likelihood* method to estimate the model parameters, as well as the implementation of *bootstrap procedure to 2000 resampling*, since the survey data do not satisfy the condition of multivariate normal distribution.

To start the estimation stage of the model parameters, previously, we should perform the identification procedure. According to Kline (2011), a model is identified if it is *theoretically* possible to calculate a single estimate of all model parameters by SEM software. The word "*theoretically*" emphasizes that the identification is a property of the model and not of the data. A SEM model is identified if: (1) each latent variable (including *residues*) is assigned a metric; and (2) the *degree of freedom* of the model is ≥ 0.

Regarding the first condition, in the modeling process, the adopted SEM software allows us to determine the weights of errors in 1, indicating that these latent variables have the same metric of the corresponding manifest variables. Also, we have fixed in 1 the factor weights of latent variables with their manifest variables.

To evaluate the second condition, we have calculated the number of degrees of freedom of the model, using the following relationship:

$$df = \frac{(p+q)(p+q+1)}{2} - t$$

Equation 5.10 – Degrees of freedom. Source: Marôco (2014).

Where:

p = number of dependent manifest variables

q = number of independent manifest variables

t = number of parameters to be estimated

For the model depicted in **Figure 5.15**, the number of degrees of freedom is:

$$df = \frac{(17+3)(17+3+1)}{2} - 51 = 159$$

The result indicates $df > 0$, which classify the model as "**over-identified**", a necessary condition in order to follow the model estimation and evaluate the quality of the adjustment.

The estimation of the model parameters is the most critical part of the SEM modeling and occurs generally in two stages (two-step): (1) first, we should evaluate the measurement sub-model using Confirmatory Factor Analysis (CFA), verifying the goodness of fit of the theoretical model, related to the correlational structure of manifest variables from the data sample collected during the study; and then, (2) we should specify the structural sub-model (causal relations between the latent variables), calculate the model parameters and check the quality of the overall adjustment.

As highlighted by Marôco (2014), to the causal models with latent variables, the "two-step" strategy ensures that the measurement model is first validated, avoiding lack of overall adjustment of the theoretical model for reasons inherent to the instrument.

During this study, the CFA was performed separately for each set of indicators that seek to measure the constructs of the model **Figure 5.15**. Then the full causal model was evaluated in order to confirm or not the hypotheses elaborated for this study.

5.2.5.1 Confirmatory Factor Analysis (CFA)

The *Confirmatory Factor Analysis (CFA)* was performed to six measurement sub-models designated by the names of the constructs that seek to measure: i) Effects of environmental

factors [E]; ii) Effects of moderator factors [M]; iii) Agile capabilities [A]; iv) Governance capabilities [G]; v) Business operations [B]; and vi) Value delivery [R]. Using IBM® SPSS® Amos 20.0 each sub-model was evaluated. The procedures and results of these estimates are described below.

To CFA Analysis we will adopt the same approach carried out to EFA Analysis, i.e., in the following section we will develop a detailed discussion about the CFA analysis on the construct: Effects of environmental factors [E]. However, as a matter of objectivity, we will provide the detailed CFA analysis to the remaining five constructs in the APPENDIX VII.3.

5.2.5.1.1 CFA for measurement sub-model of Effects of environmental factors [E]

After the EFA, three manifest variables measure the construct Effects of environmental factors [E]: *Technological impact* (x_1), *Economy influence* (x_4), and *Market turbulence* (x_5). The objective of this stage of modeling is to verify, using CFA, whether the correlational structure of this measurement sub-model reproduces adequately the empirical evidence of the data sample. In order to analyze this matter, we are using the SEM quality indices for model fit described in **Table 2.6**.

The CFA results for this sub-model are depicted in **Figure 5.16**, which corresponds to the screen of the fitted model with the display of standardized estimates (Default model with standardized Estimates) from IBM® SPSS® Amos 20.0.

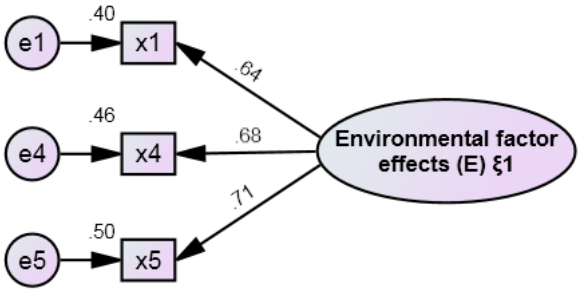


Figure 5.16 – Measurement sub-model: Effects of environmental factors [E]. Source: Own elaboration from AMOS.

In **Figure 5.16** all manifest variables have presented high *factor weights* ($\lambda \geq 0.5$), and appropriate *individual reliability* described by the *squared multiple correlations* ($R^2 \geq 0.25$). The measure sub-model demonstrated *good quality fit* as described by the indexes depicted in **Table 5.17**.

Table 5.17 – Adjustment of quality indices from the measurement sub-model: for [E], ($\boldsymbol{n = 118}$). Source: Own elaboration from AMOS.

Indexes →	χ^2	df	**p-value**	χ^2/gl	**CFI**	**GFI**	**TLI**	**RMSEA**	**p(RMESEA≤ 0.05)**
Values obtained	0.158	1	0.691	0.158	1.000	0.999	1.037	0.000	0.731
Reference values	lower is better	≥1	>0.05	<3	>0.90	>0.90	close to 1	<0.10	≥0.05
Analysis	**OK**	**OK**	**OK**	**Good fit**	**Very good fit**	**Very good fit**	**Good fit**	**Very good fit**	**Good fit**

Table 5.18 depicts other estimates calculated for this measurement sub-model. Noteworthy are the *standardized factor weights* (λ) between the latent variable [E] and its manifest variables. In all cases these values are greater than 0.5, demonstrating how the ***Effects of environmental factors [E]*** adequately "*manifest*" themselves by the *empirical indicators* from the theoretical model.

Moreover, the *standardized error* (ε) for each *regression weight* was calculated having their respective *probability* (p) less than 0.001, in all cases. For example, the *regression coefficient* for **[E]** in predicting the ***"Market turbulence"*** **(x_5)** is significantly different from zero at the 0.001 level.

Table 5.18 – CFA results for construct [E], ($\boldsymbol{n = 118}$). Source: Own elaboration from AMOS.

Relations and Variables	**Standardized Regression Weights (λ)**	**Standardized Errors (ε)**	p	**Squared Multiple Correlations (R^2)**
$x_1 \leftarrow E$	0.636	N/A	N/A	-
$x_4 \leftarrow E$	0.678	0.186	***	-
$x_5 \leftarrow E$	0.710	0.177	***	-
x_1	-	-	-	0.404
x_4	-	-	-	0.460
x_5	-	-	-	0.504

*** p <0.001
N/A: the standard error for calculating this ratio is not applicable, because the non-standard weight was set at 1 to determine the model.

The ***"Market turbulence"*** **(x_5)** of the ***Effects of environmental factors [E]*** is presented as the indicator of greatest impact (factor weight, $\lambda_{x_5} = 0.710$), and the ***"Technological impact"*** **(x_1)** the lowest effect perceived by respondents (factor weight, $\lambda_{x_1} = 0.636$). Additionally, the *square of the standard correlation coefficient* (R^2) measures the portion of variance of each indicator explained by latent factor. For example, $\mathbf{40.4\%}$ from the effects of ***"Technological impact"*** **(x_1)** perceived by the ***organizational context*** would be explained by the ***Effects of moderator factors [M]***.

For each *latent variable* (construct) of the model derived from the emerging theory depicted in Chapter 4, we have followed the same procedure. Complete details about CFA analysis from every remaining construct are available at: APPENDIX VII.3.

5.2.5.1.2 CFA for measurement sub-models: final remarks

During the CFA analysis, from the six latent constructs, only two measurement sub-models related to the constructs [G] and [R], have demanded some adjustments, in order to verify, whether the correlational structure of these measurement sub-models reproduce adequately the empirical evidence of the data sample (see details in APPENDIX VII.3).

All the adjustements performed were properly supported by theory, related works and evidences gathered during the development of this research. After those adjustments, the measurement sub-models for every construct were able to reproduce properly the empirical evidence of the data sample.

5.2.5.2 Validity assessment for model estimation

After making the CFA of measurement sub-models, following the methodology "two-step", we have continued with the evaluation of the complete model. This step considers treat together the six measurement sub-models and structural sub-model, as a second stage of SEM modeling allowing assess the causal hypotheses to the phenomena under study.

The adjustment quality of the measuring sub-models was checked by the respective indices at CFA analysis. At this stage we have attempted to assess the plausibility of the complete model, therefore we used the same indices applied to the measurement model, with the incorporation of parsimony indices. These indices check whether the best adjusted model (by adding parameters or relationships) is also a parsimonious model (simple model).

Importantly, at this stage of modeling, the conclusions of Mulaik (2009), who warns that the indices applied to the global model (measurement sub-model + structural sub-model) are influenced largely by the quality of the measurement sub-model adjustment, but influencing less the quality adjustment of the structural sub-model. This situation is justified by the number of parameters associated with the measurement sub-model when compared to the parameters of the structural sub-model.

We will adopt the same approach carried out to EFA and CFA Analysis to Model estimation. We have models from the eight theoretical scenarios depicted by the theory to estimate. Then, in the following section we will develop a detailed discussion about the **Startup Scenario (φ_4)** estimation. However, as a matter of objectivity, we will provide the detailed discussion about to the remaining models from the seven theoretical scenarios in the APPENDIX VII.4.

5.2.5.2.1 Model estimation for validity analysis: Startup Scenario (φ_4)

From the model based on Startup Scenario (φ_4), adjusted after EFA, and depicted in **Figure 5.15**, we have performed the estimation of the complete model (measurement sub-model + structural sub-model) with the aid of *IBM SPSS Amos 20.0* software, using the bootstrap procedure with 2000 resampling. The results of the estimation for the complete model are depicted in **Figure 5.17**, as well as its adjustment indices are presented in **Table 5.19**.

In order to improve the model quality adjustment indices we have correlated the measurement errors from variables $\boldsymbol{y_{17}}$ and $\boldsymbol{y_{18}}$, based on discussion carried out in Section VII.3.5.

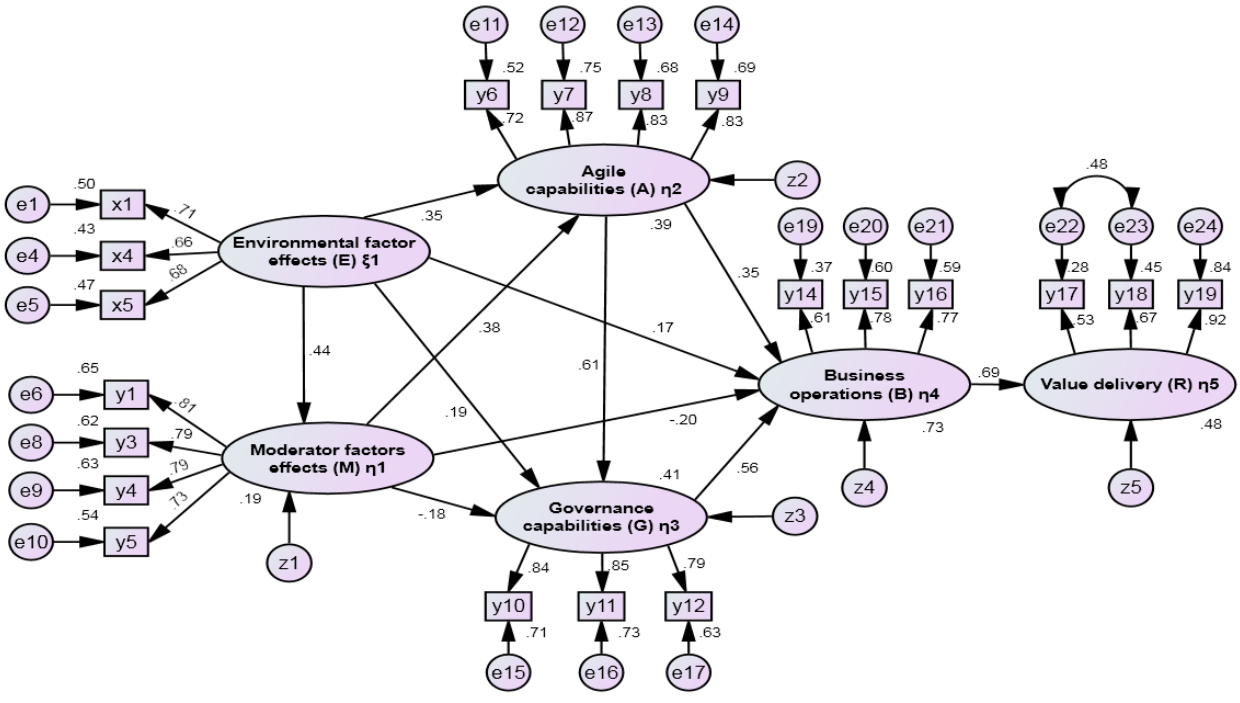


Figure 5.17 – Estimated model of structural equations with standardized weights for Startup Scenario (φ_4), ($n = 118$). **Source**: Own elaboration.

Observing the data in **Table 5.19**, we can realize that apart from the **GFI** and **NFI**, the indices used meet the references suggested in the literature (Hair et al., 2009; Kline, 2011; Lomax and

Schumacker, 2012; Marôco, 2014). Although the **GFI** and **NFI** values were less than 0.9, they were appreciably high, being above 0.8.

Table 5.19 – Quality adjustment indices from model based on Startup Scenario (φ_4), depicted in Figure 5.15, ($\boldsymbol{n = 118}$). **Source:** Own elaboration from AMOS.

Group Analysis	Indices	Obtained values	Reference values for Analysis	Analysis
Fit tests	*Chi-square* ***(χ^2)***	202.300	lower is better	-
	Degrees of freedom ***(df)***	158	≥1	OK
	p-value	0.010	>0.05	OK
Absolute Indices	*Standardized Chi-square* ***(χ^2/df)***	1.280	<3	OK
	Root Mean Square Error of Approximation ***(RMSEA)***	0.049	<0.10	Good fit
	Goodness of Fit Index ***(GFI)***	0.857	>0.90	Acceptable fit
Relative Indices	*Comparative Fit Index* ***(CFI)***	0.962	>0.90	Good fit
	Normed Fit Index ***(NFI)***	0.851	>0.90	Acceptable fit
	Tucker-Lewis Index ***(TLI)***	0.954	>0.90	Good fit
Parcimony Indices	*Parsimony GFI* ***(PGFI)***	0.644	>0.60	Good fit
	Parsimony CFI ***(PCFI)***	0.800	>0.60	Good fit
	Parsimony NFI ***(PNFI)***	0.708	>0.60	Good fit
		Solution is admissible	-	Acceptable Fit

Even though GFI values should be considered greater than 0.90, where zero value for GFI means a poor fit and value equal to 1 a perfect fit (Jöreskog and Sörbom, 1996). In this study the values of GFI was around 0.90 but still at a marginal acceptance level and relatively close to the preferred values. Zikmund (2003) argued that values of GFI less than 0.90, do not necessarily mean that the model has a poor fit. GFI tends to be larger as sample size increases.

In turn, NFI greater than or equal to 0.90 indicates acceptable model fit. NFI less than 0.90 can usually be improved substantially. However, some authors, such as (Bollen, 1989), have used the more liberal cutoff of 0.80. NFI also depends on sample size, values of the NFI will be higher for larger sample sizes. NFI behaves erratically across estimation methods under conditions of small sample size. NFI is not a good indicator for evaluating model fit when the sample size is small. CFI is more appropriate than NFI in finite samples. Marsh et al. (1996) recommended against using NFI and in favor of TLI, because NFI, not TLI, is sensitive to sample size. When the sample size is small, both the CFI and TLI decrease as we increase the number of variables in the model.

In this study, we can imply that the **GFI** and **NFI** values lower than 0.90 are consequence from a sample size that is not so large, but not necessarily, due to a bad model fit. We can conclude that the model reproduces properly (plausibly) the correlation of empirical data structure.

Despite **GFI** and **NFI** values were lower than 0.90, they were higher than 0.80 allowing us classify the overall analysis of the quality adjustment indices as **acceptable** (see **Table 2.6**), for the purpose it is intended for this empirical study: to evaluate the plausibility of the emerging theory.

The model includes 51 variables (20 manifest or observed and 31 latent or unobserved) of which 26 are independent (or exogenous) and 25 dependents (or endogenous). 25 factorial charges were fixed and estimated 31 factorial weights, 1 covariance and 26 variances (83 parameters in total). Thus, the number of different elements of the covariance matrix was 210 for 158 degrees of freedom ($df = 201 - 52 = 158$). The maximum likelihood method was used, and the algorithm achieved the minimum of the discrepancy function in the iterative process for $\chi^2 = 202.300$.

In each theoretical scenario, the hypotheses (from H_1 to H_{16}) were assessed by means of *Path Analysis* approach Marôco (2014). In case of the hypothesis H_{16} we have assessed the supposed *mediation* between the constructs [A] (predictor variable) and [B] (dependent variable), through [G] (mediator variable), adopting two statistical tests: (1) Sobel Test for Mediation (Marôco, 2014; Sobel, 1982); and, (2) Bootstrap Test for Mediation (Marôco, 2014, p. 155).

For *Sobel Mediation Test* we have used the **Equation 5.11**:

$$Z = \frac{\hat{\beta}_{G\leftarrow A} \times \hat{\beta}_{B\leftarrow G}}{\sqrt{{\hat{\beta}_{B\leftarrow G}}^2 \times {\sigma_{G\leftarrow A}}^2 + {\hat{\beta}_{G\leftarrow A}}^2 \times {\sigma_{B\leftarrow G}}^2 + {\sigma_{G\leftarrow A}}^2 \times {\sigma_{B\leftarrow G}}^2}}$$

Equation 5.11 – Sobel Test for Mediation. Source: Marôco (2014, p. 145).

Where:

$\hat{\beta}_{G\leftarrow A}$ = Non standardized direct effect from $A \rightarrow G, \therefore$ Non standardized value for H_1

$\hat{\beta}_{B\leftarrow G}$ = Non standardized direct effect from $G \rightarrow B, \therefore$ Non standardized value for H_2

$\sigma_{G\leftarrow A}$ = Standard error of regression weight for $\beta_{G\leftarrow A}$

$\sigma_{B\leftarrow G}$ = Standard error of regression weight for $\beta_{B\leftarrow G}$

Those values were obtained from *IBM SPSS Amos 20.0* software for each theoretical scenario, and calculated in a electronic spreadsheet. The hypotheses to test the significance of the mediation effect are:

H'_M: $\hat{\beta}_{G\leftarrow A} \times \hat{\beta}_{B\leftarrow G} = 0$, the effect is not significant. (There is not mediation)

H''_M: $\hat{\beta}_{G\leftarrow A} \times \hat{\beta}_{B\leftarrow G} \neq 0$, the effect is significant. (There is mediation)

Under the validity of the assumptions of SEM, or for large samples, the Z statistic has asymptotic standardized normal distribution. Then, $H'_M$is rejected if $|Z| \geq Z_{1-\alpha/2}$, see (Marôco, 2014, p. 369).

For the *Bootstrap Test for Mediation* we have applied *IBM SPSS Amos 20.0* software, using the bootstrap procedure with 2000 resampling and BootstrapML method.

For the test of each hypothesis from the current model, according to Marôco (2014), we have analyzed the value of the ***path coefficients*** (β), i.e., the "standardized regression weights" for related constructs (latent variables) of the structural sub-model, as causal linkages between statistical variables in the structural equation modeling approach. Likewise, we consider their **estimated probability** of getting a sample value this far from zero if the population value is zero (p), i.e., the "level of significance for each regression weight" (Efron and Tibshirani, 1994).

For each hypothesis, when **estimated probability** (p) is statistically significant, its ***path coefficient*** (β) is recognized as a valid causal linkage between the constructs under analysis. In other words, we reject β for $p > 0.05$.

Regards to the ***hypotheses testing***, in the scenario under analysis there are 12 hypotheses from 16 hypotheses depicted from the emerging theory, which we intend to test. Their test result and analysis are depicted in **Table 5.20**.

In order to illustrate the rationale of the hypothesis test, adopting SEM Path Analysis approach, we will detail the analysis developed for the hypothesis H_1, as follows**:**

> ***H_1*** *can be confirmed ($\beta_{H_1} = 0.606$, $p_{H_1} < 0.001$ $***$), because the probability of getting a* ***critical ratio*** *as large as 4.379 in absolute value is less than 0.001. In other words, the* ***regression weight*** *for [A] in the prediction of [G] is significantly different from zero at the 0.001 level (two-tailed). Further, when [A] goes up by one* ***standard deviation****, [G] goes up by 0.606* ***standard deviations****. Hence, analyzing the current scenario, based on the data sample gathered by this empirical study, we can*

substantiate that "the agile capabilities [A] have a positive influence on governance capabilities [G]" in the **Startup Scenario (φ_4)** *with enough statistical significance.*

However, as a matter of objectivity we will not detail the analysis for every hypothesis in each theoretical scenario, we will only depict the test results for each hypothesis.

Table 5.20 – Hypothesis test for Startup Scenario (φ_4), ($\boldsymbol{n = 118}$). **Source:** Own elaboration from AMOS.

Hypotheses		Startup Scenario (φ_4)	Test	Comments
H_1	Agile governance [$G \leftarrow A$]	Significant ($\beta = 0.606$, ***)	Confirmed	N/A
H_2	Agile governance [$B \leftarrow G$]	Significant ($\beta = 0.557$, ***)	Confirmed	N/A
H_3	Specific agility [$B \leftarrow A$]	Significant ($\beta = 0.349$, $p = 0.011$ *)	Confirmed	N/A
H_4	Value delivery [$R \leftarrow B$]	Significant ($\beta = 0.691$, ***)	Confirmed	N/A
H_5	Moderator factors effects [$B \leftarrow M$]	Non-significant ($\beta = -0.196$, $p = 0.066$)	Not confirmed	Despite we can identify the negative influence from [M] upon [B] in current scenario, the hypothesis has no enough statistical significance.
H_6	Environmental factors effects [$B \leftarrow E$]	Non-significant ($\beta = 0.169$, $p = 0.144$)	Not confirmed	In spite of the hypothesis not having statistical significance, the influence identified from [E] upon [B] by the study is slight and positive. In fact, when we realize that not only threats (negative influence) from Environmental factors effects [E] can jeopardize Business operations [B], but also opportunities (positive influence) can potentiate it. This evidence is supported by the emerging theory.
H_7	Moderator factors effects [$A \leftarrow M$]	Significant ($\beta = 0.384$, ***)	Confirmed	In spite of the hypothesis having statistical significance, the influence identified from [M] upon [A] by the study is positive, instead negative as depicted in the statement of the hypothesis. This result leads us to think whether: (1) it would be this one occurrence of the behavior changing from Moderator factors effect [M] into enabler ones, such as when it is empowered by the combination of agile and governance capabilities; or, (2) whether, this result can be a consequence of the multiple organizational context shuffled into the data sample; or even, (3) this evidence can be an effect from the wording (quite generic questions) we have asked on the questionnaire. Regardless any of these hypotheses, this denotement has to be further investigated in future studies.

Hypotheses		Startup Scenario (φ_4)	Test	Comments
H_8	Moderator factors effects $[G \leftarrow M]$	Non-significant ($\beta = -0.184$, $p = 0.131$)	Not confirmed	Although we have identified the negative influence from [M] upon [G] in current scenario, the hypothesis has no enough statistical significance.
H_9	Environmental Factors effects $[A \leftarrow E]$	Significant ($\beta = 0.350$, $p = 0.005$ **)	Confirmed	In spite of the hypothesis having statistical significance, the influence identified from [E] upon [A] by the study is positive, instead negative as depicted in the statement of the hypothesis. In fact, when we realize that not only threats (negative influence) from Environmental factors effects [E] can disturb Agile capabilities [G] development, but also opportunities (positive influence) can leverage it. This evidence is supported by the emerging theory.
H_{10}	Environmental factors effects $[G \leftarrow E]$	Non-significant ($\beta = 0.192$, $p = 0.131$)	Not confirmed	In spite of the hypothesis not having statistical significance, the influence identified from [E] upon [G] by the study is slight and positive. In fact, when we realize that not only threats (negative influence) from Environmental factors effects [E] can disturb Governance capabilities [G] development, but also opportunities (positive influence) can leverage it. This evidence is supported by the emerging theory.
H_{11}	Environmental factors effects $[M \leftarrow E]$	Significant ($\beta = 0.439$, ***)	Confirmed	N/A
H_{12}	Sustainability $[M \leftarrow A]$	N/A	N/A	N/A
H_{13}	Competitiveness $[E \leftarrow A]$	N/A	N/A	N/A
H_{14}	Sustainability $[M \leftarrow G]$	N/A	N/A	N/A
H_{15}	Competitiveness $[E \leftarrow G]$	N/A	N/A	N/A

Hypotheses		Startup Scenario (φ_4)	Test	Comments
H_{16}	Agile Governance mediation $\begin{bmatrix} A & & \\ \downarrow & \searrow & \\ G & \rightarrow & B \end{bmatrix}$	• **Sobel test:** ▪ For $\alpha = 0.05$, $\lvert Z \rvert = 2.965 > Z_{0.975} = 1.96$, $p = 0.003$ **: significant • **Bootstrap test:** ▪ For $p_{A\rightarrow B} = 0.001$ ***, $p_{G\rightarrow B} = 0.002$ ** *: significant	Confirmed by both tests	The Governance capabilities [G] has an mediation effect of the Agile capabilities [A] upon the Business Operations [B]. In other words, the total effect caused by [A] on [B] can be separated into direct effect of trajectory [A→B] ($\beta_{A\rightarrow B} = 0.349;\ p < 0.011$ *), as well as the indirect effect of the trajectory described by [A→G] ($\beta_{A\rightarrow G} = 0.606;\ p < 0.001$***) and [G→B] ($\beta_{G\rightarrow B} = 0.557;\ p < 0.001$***). Cohen et al. (2003) suggest that when all trajectories between mediators are significant, then the global mediation effect is also significant. As pointed out by Little et al. (2007), a *partially mediated relationship* is indicated if the direct effect of the mediator construct,[G], accounts for a significant amount of variance in [B], while the direct effect of the predictor construct [A] remains significant. Based on those results, we can also imply that the effect of Agility [A] on Business Operations [B] has an greater intensity when applied by means of the mediation of Governance capabilities [G], than when applied directly upon [B]. These findings are empirical evidences from the plausibility of: 1st Law, 2nd Law, and theory's premises.
	Statistics	**Passed**: 8/12 **Refuted**: 4/12	-	-
	Analysis	67% success	-	-

Where: "β" are"standardized regression weights", pointing out the factor validity between related variables [$Y \leftarrow X$], and "p" are "standard errors", pointing out the statistical significance from each relation (β).
* This means that in the relation [$Y \leftarrow X$] the regression weight for X in the prediction of Y is significantly different from zero at the **0.05** level (two-tailed).
** This means that in the relation [$Y \leftarrow X$] the regression weight for X in the prediction of Y is significantly different from zero at the **0.01** level (two-tailed).
*** ***p*<0.001**, this means that in the relation [$Y \leftarrow X$] the regression weight for X in the prediction of Y is significantly different from zero at the 0.001 level (two-tailed).
N/A: When the hypothesis is not contemplated in the scenario.

5.2.5.2.2 The reliability and validity of the instrument

The model re-specification process changed the correlation structure between the variables, for this reason, it was re-assessed reliability of the set of indicators. **Table 5.21** depicts the internal consistency of the instrument to measure the latent constructs, after removing the manifest variables: x_2, x_3, y_2, and y_{13}.

Cronbach's Alpha results show improved internal consistency of the indicators of the constructs [E] and [G], and no significant improvement for [M], after modification of the model. In

addition, we can see a slight reduction of the internal consistency from overall sample, even maintaining the reliability analysis on excellent level.

Table 5.21 – Internal consistency of the questionnaire: based on the gathered data reliability. Source: Own elaboration.

Measurement instrument	**Number of Items Before**	**Number of Items After**	**Cronbach's Alpha (*standardized α*) Before**	**Cronbach's Alpha (*standardized α*) After**	**Reliability analysis according to** (Gliem and Gliem, 2003; Murphy and Davidshofer, 2005)
Global	24	20	0.914 *(0.915)*	0.902 *(0.905)*	Excellent
Effects of environmental factors [E]	5	3	0.714 *(0.715)*	0.725 *(0.725)*	Good
Effects of moderator factors [M]	5	4	0.861 *(0.861)*	0.860 *(0.862)*	Very good
Agile capabilities [A]	4	4	0.880 *(0.883)*	0.880 *(0.883)*	Very good
Governance capabilities [G]	4	3	0.823 *(0.835)*	0.864 *(0.868)*	Very good
Business operations [B]	3	3	0.786 *(0.785)*	0.786 *(0.785)*	Good
Value delivery [R]	3	3	0.808 *(0.809)*	0.808 *(0.809)*	Very good

On the other hand, it is necessary to assess the ***validity*** *of the instrument*, this analysis concerns the soundness of inferences from the scales used in the measurement instrument (questionnaire). That is, whether the scores obtained from the observed variables transmit to the researcher the construct information that he or she wish to evaluate. This analysis is important because the constructs are hypothetical and they are not directly observable (they are latent), and therefore they can only be measured indirectly by means of the scores of its empirical indicators (Kline, 2011).

5.2.5.2.3 Validity related to the constructs

Unfortunately, there is no single definitive test of the validity of the instrument. Instead usually is investigated by SEM analysis the so-called "**validity related to construct**", dissociated into three components: (i) *factor validity*; (ii) *convergent validity*; and, (iii) *discriminant validity*.

The ***factor validity*** analyzes whether the indicators measure adequately the construct in question. In order to do that, the standardized factor weights (λ_{ij}) are quantified, and it is assumed that the construct has factor validity when $\lambda_{ij} \geq 0.5$, for every manifest variable, which describes it (Lomax and Schumacker, 2012; Marôco, 2014). **Table 5.22** depicts the results of the factor validity of the constructs from this study, processed in IBM SPSS Amos 20.0 software.

The values of the standardized factor weights, between each construct and its manifest variables, are all greater than 0.5, and with appropriate level of significance, pointing out the existence of factor validity.

Table 5.22 – Factor validity from the constructs. Source: Own elaboration from AMOS.

Constructs	Manifest variables (Empirical indicators)		Standardized factor weights (λ)	Level of significance for regression weight (p)
Effects of environmental factors [E]	x_1	Technological impact	0.710	N/A
	x_4	Economic influence	0.657	***
	x_5	Market turbulence	0.682	***
Effects of moderator factors [M]	y_1	Organizational culture refractoriness	0.808	N/A
	y_3	Enterprise architecture inadequacy	0.788	***
	y_4	Business model inadequacy	0.794	***
	y_5	Low-skilled people	0.734	***
Agile capabilities [A]	y_6	Flexibility	0.721	N/A
	y_7	Leanness	0.866	***
	y_8	Agility	0.826	***
	y_9	Adaptability	0.831	***
Governance capabilities [G]	y_{10}	Strategic alignment	0.844	N/A
	y_{11}	Decision making	0.852	***
	y_{12}	Control	0.794	***
Business operations [B]	y_{14}	Business process driven approach	0.612	N/A
	y_{15}	Projects driven approach	0.777	***
	y_{16}	Best practices adoption	0.767	***
Value delivery [R]	y_{17}	Utility for product or service	0.528	N/A
	y_{18}	Warranty for product or service	0.673	***
	y_{19}	Time-to-market for product or service	0.917	***

***p <0.001**: this means that in the relation [$Construct \leftarrow Manifest\ variable$] the regression weight for $Manifest\ variable$ in the prediction of the $Construct$ is significantly different from zero at the 0.001 level (two-tailed).
N/A: For some items were not calculated the standard errors because their charges were set at 1.0, for model identification purposes and calculation.

A set of variables that presumably measuring the same construct demonstrates ***convergent validity*** whether their correlations are, at least, moderate in magnitude. In keeping with Marôco (2014) this circumstance occurs whether the reflexes of a factor saturate strongly this same factor. This occurrence can be measured by the *Average Variances Extracted (AVE)*, and calculated by the following equation:

$$AVE = \frac{\sum_{i=1}^{k} \lambda_{ij}^2}{\sum_{i=1}^{k} \lambda_{ij}^2 + \sum_{i=1}^{k} \varepsilon_{ij}}$$

Equation 5.12 – Average Variances Extracted (AVE). Source: Marôco (2014).

Where:

AVE = Average Variances Extracted from construct "j"

λ_{ij} = Standardized factor weights between manifest variable "i" and the construct "j"

ε_{ij} = Measurement error of the indicator $(1 - \lambda_{ij})$

Values for $AVE_j \geq 0.5$ indicate adequate convergent validity. Analyzing **Table 5.23**, there has been *convergent validity* for every construct.

Table 5.23 – Convergent validity and composite reliability from the constructs. Source: Own elaboration.

Construct	AVE	CR
Effects of environmental factors [E]	0.781	0.915
Effects of moderator factors [M]	0.870	0.964
Agile capabilities [A]	0.882	0.967
Governance capabilities [G]	0.916	0.970
Business operations [B]	0.786	0.916
Value delivery [R]	0.714	0.877

Additionally, the *Composite Reliability (CR)* evaluates the degree in which the empirical indicators from a construct measure the latent concept related to it. The calculating formula for CR is:

$$CR = \frac{(\sum_{i=1}^{k} \lambda_{ij})^2}{(\sum_{i=1}^{k} \lambda_{ij})^2 + \sum_{i=1}^{k} \varepsilon_{ij}}$$

Equation 5.13 – Composite Reliability (CR). Source: Marôco (2014).

Where:

AVE = Composite Reliability from construct "j"

λ_{ij} = Standardized factor weights between manifest variable "i" and the construct "j"

ε_{ij} = Measurement error of the indicator $(1 - \lambda_{ij})$

An acceptable reference, in keeping with to Mulaik (2009) to the Composite Reliability is $CR_j \geq 0.7$. As depicted in **Table 5.23**, all constructs from the model have very good CR values.

Finally, the ***discriminant validity*** is verified when the items that operationalize a factor are not correlated with items of other factors. In other words, the sets of indicators are essentially different for each construct. Marôco (2014) suggests the existence of discriminant validity whether AVE of the factors (both: i and j) are *greater than, or equal to, the square of the correlation value for those factors* (Φ_{ij}).

The results from **Table 5.24** confirm the *discriminant validity* for every construct. On the other hand, from the table values of *Squared Multiple Correlations* calculated by IBM® SPSS® Amos,

was elaborated a summary depicted in **Table 5.25** for all endogenous latent variables of the model.

Table 5.24 – Discriminant validity from the constructs for Startup Scenario (φ_4), ($\boldsymbol{n = 118}$). Source: Own elaboration.

i	←	j	Φ_{ij}	Φ_{ij}^2	AVE_i	AVE_j	$AVE_i \wedge AVE_j \geq \Phi_{ij}^2$?
A	←	M	0.384	0.147	0.882	0.870	OK
A	←	E	0.350	0.123	0.882	0.781	OK
B	←	A	0.346	0.120	0.786	0.882	OK
B	←	G	0.560	0.314	0.786	0.916	OK
B	←	E	0.170	0.029	0.786	0.781	OK
B	←	M	-0.196	0.038	0.786	0.870	OK
G	←	A	0.606	0.367	0.916	0.882	OK
G	←	M	-0.184	0.034	0.916	0.870	OK
G	←	E	0.192	0.037	0.916	0.781	OK
M	←	E	0.439	0.193	0.870	0.781	OK
R	←	B	0.693	0.480	0.714	0.786	OK

We found that 72.6% of the variance of Business operations [B] and 48.1% of the variance of Value delivery [R] can be explained by the model proposed for Startup Scenario (φ_4). It is a high explanatory power, for more than half of business operations [B], as well as for almost half of value delivery [R], can be measured by changes in the constructs included in the modeling, the remaining variance (27.4% and 51.9%, respectively for [B] and [R]) is attributed to factors not considered in the model depicted for this scenario. In other words, for instance, it is estimated that the predictors of [B] explain 72.6% of its variance, i.e., the error variance of [B] is approximately 27.4% of the variance of [B] itself.

Table 5.25 – Variance explained by endogenous latent constructs for Startup Scenario (φ_4), ($\boldsymbol{n = 118}$). Source: Own elaboration from AMOS.

Endogenous latent variables	% of explained variance by the model
Effects of moderator factors [M]	19.3
Agile capabilities [A]	38.8
Governance capabilities [G]	40.8
Business operations [B]	72.6
Value delivery [R]	48.1

5.2.5.3 Estimation for the models from the remaining theoretical scenarios

After checking the reliability and validity of the measuring instrument, we will proceed to estimate the full model and the confirmation or rejection of the causal hypotheses to the phenomena under study, in every theoretical scenario from the emerging theory, depicted in **Figure 4.14**, and disscussed in Section **4.5.3**.

In other words, from now we will proceed to test the complete structural model, in each theoretical scenario, that is, simultaneously estimate relations between the constructs and assess scenarios plausability.

We understand that when we vary from one theoretical scenario to another, the values for: *internal consistency* of the data collection instrument, *factor validity*, and *convergent validity*; they remain constant because they are associated to the relation between each construct and its manifest variables. In other words, they are exclusively related to the *measurement sub-model*, which does not change from one scenario to another. Hence, we will not need to recalculate their values for each of those scenarios.

On the other hand, the ***discriminant validity***, as well as ***quality adjustment indices*** vary from one scenario to another, because they are also associated to the *structural sub-model*, which depicting the relationship between the constructs, present in each scenario, and they have to be recalculated for each scenario.

As a matter of practicality, we will depict the *Structural Equation Model* and the *Estimated Model* in the same figure for each theoretical scenario from the emergin theory, followed by tables depicting the *discriminant validity* and the *quality adjustment indices* from them. Further, we present a table synthesizing the hypothesis test in each scenario, pursued by discussion and conclusion about the study findings.

We will adopt the same approach carried out to EFA and CFA Analysis to Model estimation. We have models from the eight theoretical scenarios depicted by the theory to estimate. Then, as a matter of objectivity, the detailed discussion about to the remaining models from the seven theoretical scenarios is available in the APPENDIX VII.4.

5.2.5.4 Overall analysis of the study hypotheses

Once verified the model fit for each theoretical scenario regarding to the empirical data, as well as analyzed their explanatory power, and test the hypothesis in every scenario, we proceeded to analyze the overall understanding about the study findings.

Table 5.26 depicts the goodness fit indices of the SEM model for each scenario, while **Table 5.27** portraits the standardized regression coefficients (β), and the significance levels (p)

associated with each hypothesis in every scenario analyzed. In this research, following the common practice of SEM studies, the Critical Ratio (CR) is treated as "t value"[71], which is associated with the "t test" used to check if the factor weights between two variables are significantly different from zero for a given level probability. Typically, according to Marôco (2014), regarding to CR, they are accepted values of $t > 1.96$, i.e., $p - value < 0.05$ (two tailed), which means that the findings have significance at 97.5% confidence level, in keeping with Vincent and Weir (1994).

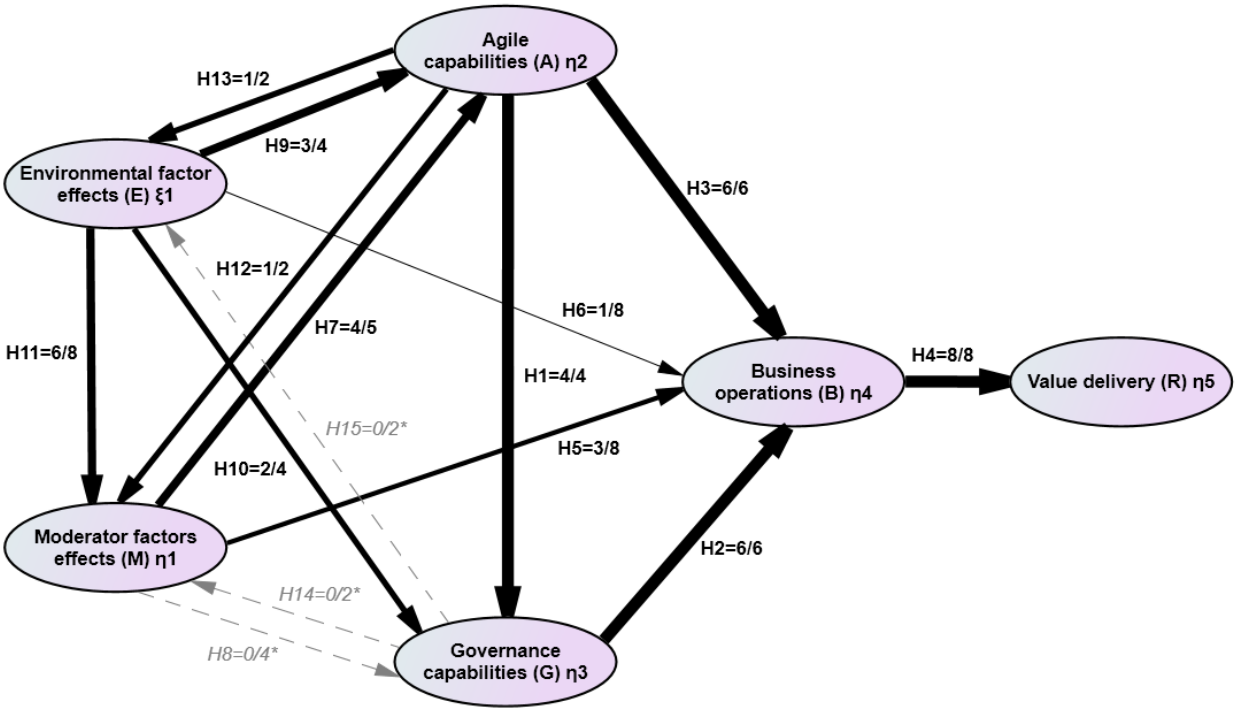


Figure 5.18 – Overall hypothesis analysis from the model of structural equations based on *Dynamic Scenario* (φ_n), ($n = 118$): structural sob-model. Source: Own elaboration.

Figure 5.18 depicts graphically the hypotheses represented by the unidirectional arrows (relationships between constructs). For each arrow is depicted the hypothesis code and number of times in which the hypothesis was confirmed, separated by the sign "/" from the number of times the same hypothesis was tested in all scenarios. For instance, $\boldsymbol{H_1}$ was confirmed in *four* scenarios out of *four* scenarios in which it was tested. The hypotheses confirmed are indicated by **black solid lines**, where the line width is associated with the frequency with which each hypothesis was confirmed in various scenarios studied. In turn, the hypotheses not confirmed (which have no meaningful relationships) are represented by *gray dashed lines*.

[71] Adopting the notation suggested by Marôco (2014), during hypotheses testing we have used the notation $|Z|$ for characterize "t value", as depicted in Sobel test for H_{16}, at **Table VII**.67.

We can notice that the **hypotheses H_1, H_2, H_3, H_4, and H_{16} were confirmed in all scenarios**. These hypotheses are related to the *key constructs* ([A], [G], [B], [R]) and *core assumptions* of the emerging theory, including the coherence of the agile governance concept, characterization and differentiation between agile governance approach and specific agile approach, as well as allowing us interpret these findings as empirical evidences from the theory plausibility, in many aspects such as: 1st Law, 2nd Law, 6th Law, and theory's premises. Based on the results of mediation analysis from H_{16}, we can also imply that the effect of Agility [A] on Business Operations [B] has an greater intensity when applied by means of the mediation of Governance capabilities [G], than when is applied directly upon [B].

Other **hypotheses were confirmed just in some scenarios, such as: H_5, H_6, H_7, H_9, H_{10}, H_{11}, H_{12}, and H_{13}.** These hypothesis are related to the interaction among the *key constructs* and the *surrounding* (*disturbing* and *restraining) constructs* ([E], [M], respectively). As a consequence, we can infer this instability related to the hypothesis confirmation to the choice of the set of empirical indicators to measure those constructs, because they are those which are more sensitive to the nature of the organizational context boundaries, in a way that how much generic were those constructs, more inaccurate was our measure from them. This inference is also supported by the explanatory power identified in each scenario for those constructs: they often are the constructs with lesser *squared multiple correlation*. For instance, in *Dynamic Scenario* (φ_n) it is estimated that the predictors of [E] explain 14 percent of its variance. In other words, the error variance of [E] is approximately 86 percent of the variance of [E] itself. Regardless, we can imply that the hypotheses from this second group are true in the respective theoretical scenarios where they were confirmed, pointing out the behavior depicted by these hypotheses as plausible in those scenarios. However, we believe that further studies are necessary to develop a deeper analysis and reach more consistent conclusions.

Finally, **only hypotheses H_8, H_{14}, and H_{15}, could not be confirmed in any scenario**. None of these hypotheses had no enough statistical significance according to the data collected by this study. Adding to the previous inference discussed in previous paragraph, we should imply other reasons for this results, such as: (1) this result can be a consequence of the multiple organizational context shuffled into the data sample; or, (2) this evidence can be an effect from the wording (quite generic questions for some empirical indicators) we have asked on the questionnaire; or even, (3) an inaccurate characterization of some empirical indicator, allowing

the respondent to answer some question without fully understanding of what it was desired to measure.

At same time, lessons learned derived from this study, about the amplitude of the phenomena under study and the particularity of each subsample, suggest that the data collection instrument shall be tailored according: (1) each organizational context, because context boundaries delimit the type of empirical indicator that shall be chosen to measure constructs (specially regarding to surrounding constructs such as [E] and [M]); (2) the characterization of theoretical scenario suitable to the respondent actuality; and, (3) positioning organizational context organizational on the chaos and order scale; in order to obtain more accurate data for analyze theory: generalization, causality, explanation, and prediction.

Althought not all hypotheses have been confirmed in all scenarios, the Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM) analysis points out the plausibility of the theory components and hypotheses. In general, the results present evidences of the theory plausibility, indicating that further studies are necessary to reach with a trustworthy theory to describe and analyze the agile governance phenomena. This way we can conclude that the empirical study in question has succeeded in assessing the plausibility of the theory. Regardless, these findings have to be further investigated in future studies in order to refine the emerging theory.

Regarding to our research design the completion of this Section ends the stage 3, depicted in **Figure 2.1** (see Section 2.2).

Table 5.26 – Quality adjustment indices from Agile Governance theoretical scenarios, ($\boldsymbol{n = 118}$). Source: Own elaboration from AMOS.

Group Analysis	Indices	Beginner Scenario (φ_0)	Governance experience Scenario (φ_1)	Agile or Lean culture Scenario (φ_2)	Dissociative Scenario (φ_3)	Startup Scenario (φ_4)	Sustainability Scenario ($\varphi_{5'}$)	Competitive-ness Scenario ($\varphi_{5''}$)	Dynamic Scenario (φ_n)	Reference values for Analysis
Fit tests	*Chi-square* ***(χ^2)***	58.980	142.640	112.520	223.829	202.300	203.838	204.705	218.480	lower is better
	Degrees of freedom ***(df)***	61	96	112	159	158	159	159	158	≥1
	p-value	0.549	0.001	0.468	0.001	0.010	0.009	0.008	0.001	>0.05
Absolute Indices	*Standardized Chi-square* ***(χ^2/df)***	0.967	1.486	1.005	1.408	1.280	1.282	1.287	1.383	<3
	Root Mean Square Error of Approximation ***(RMSEA)***	0.000	0.064	0.006	0.059	0.049	0.049	0.050	0.057	<0.10
	Goodness of Fit Index ***(GFI)***	0.928	0.874	0.901	0.844	0.857	0.856	0.856	0.848	>0.90
Relative Indices	*Comparative Fit Index* ***(CFI)***	1.000	0.945	0.999	0.945	0.962	0.962	0.961	0.948	>0.90
	Normed Fit Index ***(NFI)***	0.907	0.852	0.890	0.835	0.851	0.850	0.850	0.839	>0.90
	Tucker-Lewis Index ***(TLI)***	1.005	0.931	0.999	0.934	0.954	0.954	0.953	0.938	>0.90
Parcimony Indices	*Parsimony GFI* ***(PGFI)***	0.622	0.617	0.659	0.639	0.644	0.648	0.648	0.638	>0.60
	Parsimony CFI ***(PCFI)***	0.782	0.756	0.823	0.790	0.800	0.805	0.804	0.789	>0.60
	Parsimony NFI ***(PNFI)***	0.710	0.681	0.733	0.699	0.708	0.711	0.711	0.698	>0.60
	Overall Goodness of Fit	Good Fit	Acceptable fit	Acceptable fit	Acceptable fit	Acceptable fit	Acceptable fit	Acceptable fit	Acceptable fit	-

Table 5.27 – Hypothesis test for Agile Governance theoretical scenarios, ($\boldsymbol{n = 118}$). Source: Own elaboration from AMOS.

Hypotheses		Beginner Scenario (φ_0)	Governance experience Scenario (φ_1)	Agile or Lean culture Scenario (φ_2)	Dissociative Scenario (φ_3)	Startup Scenario (φ_4)	Sustainability Scenario ($\varphi_{5'}$)	Competitive-ness Scenario ($\varphi_{5''}$)	Dynamic Scenario (φ_n)	Statistics	Analysis
H_1	Agile governance [$G \leftarrow A$]	N/A	N/A	N/A	N/A	Significant ($\beta = 0.606$, ***)	Significant ($\beta = 0.613$, ***)	Significant ($\beta = 0.587$, ***)	Significant ($\beta = 0.652$, ***)	**Passed**:4/4 **Refuted**:0/4	100% success
H_2	Agile governance [$B \leftarrow G$]	N/A	Significant ($\beta = 0.720$, ***)	N/A	Significant ($\beta = 0.589$, ***)	Significant ($\beta = 0.557$, ***)	Significant ($\beta = 0.568$, ***)	Significant ($\beta = 0.576$, ***)	Significant ($\beta = 0.540$, ***)	**Passed**:6/6 **Refuted**:0/6	100% success
H_3	Specific agility [$B \leftarrow A$]	N/A	N/A	Significant ($\beta = 0.675$, ***)	Significant ($\beta = 0.399$, $p = 0.004$ **)	Significant ($\beta = 0.349$, $p = 0.011$ *)	Significant ($\beta = 0.338$, $p = 0.016$ *)	Significant ($\beta = 0.350$, $p = 0.009$ **)	Significant ($\beta = 0.335$, $p = 0.026$ *)	**Passed**:6/6 **Refuted**:0/6	100% success
H_4	Value delivery [$R \leftarrow B$]	Significant ($\beta = 0.585$, ***)	Significant ($\beta = 0.702$, ***)	Significant ($\beta = 0.603$, ***)	Significant ($\beta = 0.677$, ***)	Significant ($\beta = 0.691$, ***)	Significant ($\beta = 0.692$, ***)	Significant ($\beta = 0.690$, ***)	Significant ($\beta = 0.682$, ***)	**Passed**:8/8 **Refuted**:0/8	100% success

Hypotheses		Beginner Scenario (φ_0)	Governance experience Scenario (φ_1)	Agile or Lean culture Scenario (φ_2)	Dissociative Scenario (φ_3)	Startup Scenario (φ_4)	Sustainability Scenario ($\varphi_{5'}$)	Competitive-ness Scenario ($\varphi_{5''}$)	Dynamic Scenario (φ_n)	Statistics	Analysis
H_5	Moderator factors effects $[B \leftarrow M]$	Non-significant ($\beta = -0.027$, $p = 0.823$)	Non-significant ($\beta = -0.071$, $p = 0.461$)	Significant ($\beta = -0.288$, $p = 0.018$ **)	Significant ($\beta = -0.222$, $p = 0.041$ *)	Non-significant ($\beta = -0.196$, $p = 0.066$)	Non-significant ($\beta = -0.198$, $p = 0.066$)	Significant ($\beta = -0.212$ $p = 0.042$)	Non-significant ($\beta = -0.195$ $p = 0.100$)	**Passed**:3/8 **Refuted**:5/8	38% success
H_6	Environmental factors effects $[B \leftarrow E]$	Significant ($\beta = 0.494$, $p = 0.002$ **)	Non-significant ($\beta = 0.232$, $p = 0.058$)	Non-significant ($\beta = 0.261$, $p = 0.052$)	Non-significant ($\beta = 0.150$, $p = 0.275$)	Non-significant ($\beta = 0.169$, $p = 0.144$)	Non-significant ($\beta = 0.181$, $p = 0.119$)	Non-significant ($\beta = 0.181$, $p = 0.138$)	Non-significant ($\beta = 0.178$, $p = 0.168$)	**Passed**:1/8 **Refuted**:7/8	13% success
H_7	Moderator factors effects $[A \leftarrow M]$	N/A	N/A	Significant ($\beta = 0.383$, ***)	Significant ($\beta = 0.336$, $p = 0.003$ **)	Significant ($\beta = 0.384$, ***)	N/A	Significant ($\beta = 0.443$, ***)	Non-significant ($\beta = 0.202$, $p = 0.233$)	**Passed**:4/5 **Refuted**:1/5	80% success
H_8	Moderator factors effects $[G \leftarrow M]$	N/A	Non-significant ($\beta = 0.050$, $p = 0.682$)	N/A	Non-significant ($\beta = 0.030$, $p = 0.814$)	Non-significant ($\beta = -0.184$, $p = 0.131$)	N/A	N/A	Non-significant ($\beta = -0.144$, $p = 0.383$)	**Passed**:0/4 **Refuted**:4/4	0% success
H_9	Environmental Factors effects $[A \leftarrow E]$	N/A	N/A	Significant ($\beta = 0.351$, ***)	Significant ($\beta = 0.457$, $p = 0.001$ ***)	Significant ($\beta = 0.350$, $p = 0.005$ **)	N/A	N/A	Non-significant ($\beta = 0.385$, $p = 0.081$)	**Passed**:3/4 **Refuted**:1/4	75% success
H_{10}	Environmental factors effects $[G \leftarrow E]$	N/A	Significant ($\beta = 0.403$, $p = 0.003$ **)	N/A	Significant ($\beta = 0.509$, $p = 0.001$ ***)	Non-significant ($\beta = 0.192$, $p = 0.131$)	N/A	N/A	Non-significant ($\beta = 0.176$, $p = 0.436$)	**Passed**:2/4 **Refuted**:2/4	50% success
H_{11}	Environmental factors effects $[M \leftarrow E]$	Significant ($\beta = 0.438$, ***)	Significant ($\beta = 0.438$, ***)	Significant ($\beta = 0.439$, ***)	Significant ($\beta = 0.447$, ***)	Significant ($\beta = 0.439$, ***)	Non-significant ($\beta = 0.235$, $p = 0.070$)	Non-significant ($\beta = 0.263$, $p = 0.066$)	Significant ($\beta = 0.380$, $p = 0.027$ *)	**Passed**:6/8 **Refuted**:2/8	75% success
H_{12}	Sustainability $[M \leftarrow A]$	N/A	N/A	N/A	N/A	N/A	Significant ($\beta = 0.531$, ***)	N/A	Non-significant ($\beta = 0.411$, $p = 0.055$)	**Passed**:1/2 **Refuted**:1/2	50% success
H_{13}	Competitiveness $[E \leftarrow A]$	N/A	N/A	N/A	N/A	N/A	N/A	Significant ($\beta = 0.332$, $p = 0.033$ *)	Non-significant ($\beta = 0.103$ $p = 0.729$)	**Passed**:1/2 **Refuted**:1/2	50% success
H_{14}	Sustainability $[M \leftarrow G]$	N/A	N/A	N/A	N/A	N/A	Non-significant ($\beta = -0.191$, $p = 0.136$)	N/A	Non-significant ($\beta = -0.221$ $p = 0.246$)	**Passed**:0/2 **Refuted**:2/2	0% success

Hypotheses		Beginner Scenario (φ_0)	Governance experience Scenario (φ_1)	Agile or Lean culture Scenario (φ_2)	Dissociative Scenario (φ_3)	Startup Scenario (φ_4)	Sustainability Scenario ($\varphi_{5'}$)	Competitive-ness Scenario ($\varphi_{5''}$)	Dynamic Scenario (φ_n)	Statistics	Analysis
H_{15}	Competitiveness $[E \leftarrow G]$	N/A	N/A	N/A	N/A	N/A	N/A	Non-significant ($\beta = 0.164$, $p = 0.252$)	Non-significant ($\beta = 0.039$, $p = 0.896$)	**Passed**:0/2 **Refuted**:2/2	0% success
H_{16}	Agile Governance mediation $\begin{bmatrix} A & & \\ \downarrow & \searrow & \\ G & \rightarrow & B \end{bmatrix}$	N/A	N/A	N/A	N/A	• **Sobel test:** ▪ For $\alpha = 0.05$, $\lvert Z\rvert = 2.965 > Z_{0.975} = 1.96$, $p = 0.003$ **: significant • **Bootstrap test:** ▪ For $p_{A\rightarrow B} = 0.001$ ***, $p_{G\rightarrow B} = 0.002$ ***: significant	• **Sobel test:** ▪ For $\alpha = 0.05$, $\lvert Z\rvert = 3.339 > Z_{0.975} = 1.96$, $p = 0.001$ ***: significant • **Bootstrap test:** ▪ For $p_{A\rightarrow B} = 0.001$ ***, $p_{G\rightarrow B} = 0.001$ ***: significant	• **Sobel test:** ▪ For $\alpha = 0.05$, $\lvert Z\rvert = 3.325 > Z_{0.975} = 1.96$, $p = 0.001$ ***: significant • **Bootstrap test:** ▪ For $p_{A\rightarrow B} = 0.001$ ***, $p_{G\rightarrow B} = 0.001$ ***: significant	• **Sobel test:** ▪ For $\alpha = 0.05$, $\lvert Z\rvert = 2.829 > Z_{0.975} = 1.96$, $p = 0.005$ **: significant • **Bootstrap test:** ▪ For $p_{A\rightarrow B} = 0.012$ **, $p_{G\rightarrow B} = 0.004$ ***: significant	**Passed**:4/4 **Refuted**:0/4	100% success
Statistics		**Passed**: 3/4 **Refuted**:1/4	**Passed**: 4/7 **Refuted**:3/7	**Passed**: 6/7 **Refuted**: 1/7	**Passed**: 8/10 **Refuted**: 2/10	**Passed**: 8/12 **Refuted**: 4/12	**Passed**: 6/10 **Refuted**: 4/10	**Passed**: 8/11 **Refuted**: 3/11	**Passed**: 6/16 **Refuted**: 10/16	-	-
Analysis		75% success	57% success	86% success	80% success	67% success	60% success	73% success	38% success	-	-
Overall Goodness of Fit		Good Fit	Acceptable fit	Acceptable fit	Acceptable fit	Acceptable fit	Acceptable fit	Acceptable fit	Acceptable fit	-	-

Where: "β" are"standardized regression weights", pointing out the factor validity between related variables $[Y \leftarrow X]$, and "p" are "standard errors", pointing out the statistical significance from each relation (β).
* This means that in the relation $[Y \leftarrow X]$ the regression weight for X in the prediction of Y is significantly different from zero at the **0.05** level (two-tailed).
** This means that in the relation $[Y \leftarrow X]$ the regression weight for X in the prediction of Y is significantly different from zero at the **0.01** level (two-tailed).
*** p**<0.001**, this means that in the relation $[Y \leftarrow X]$ the regression weight for X in the prediction of Y is significantly different from zero at the 0.001 level (two-tailed).
N/A: When the hypothesis is not contemplated in the scenario.

5.3 Theory comparison

This subsection deals with the theory comparison in exchange for pull in extant theory to compare and contrast with the proposed theory, also to examine *what is similar*, what is different, and why, in order to enhance the *internal validity*, *generalizability*, and *theoretical level of the theory building*. This Section starts the procedures related to the stage 4 of our research design, depicted in **Figure 2.1** (see Section 2.2).

5.3.1 Choosing theories to compare

In order to identify other theories in *Information Systems* (IS) area to compare with the emerging theory, we have conducted an Exploratory Literature Review (Schuetzenmeister, 2010), on the following search engine and electronic databases: Google, Google Scholar, ACM Digital library, and IEEE Xplore Digital Library. During this process, we were preferring IS theories related to *IT Governance* topic, once our theory is bounded by this *external boundary-determining* criteria. However, on that area of study we found some frameworks, models, guidelines, body of knowledges, but no (scientific) theories explicitly established, much less with respect to the theories agile governance. This preliminary result points out in the emerging theory as the first one exploring this topic.

In favor of develop a useful discussion about our theory in comparison with other ones, we will focus on the following "theoretical approaches": (1) "**Good Governance Theory**" (GG), which proposes "*increased public accountability and transparency; respect for and strengthening of the rule of law and anti-corruption measures; democratization, decentralization and local government reform; increased civil-society participation in development; and respect for human rights and the environment*" (Drake et al., 2001). Further, (2) "**New Public Management Theory**" (NPM), as a management philosophy used by Governments since the 1980s to modernize the Public Sector, "*seeking to enhance the efficiency of the governments, and pointing out that more market orientation in the public sector will lead to greater cost-efficiency for governments, without having negative side effects on other objectives and considerations*" (Min and Weidong, 2005).

In spite of those "theoretical approaches" are not bounded into the "IT Governance" domain, having the first "Global Governance" amplitude, and the second one focus on "Governance for Public Administration", the following reasons led us to choose those topics: (1) the former one is really a **trend topic related to governance**, and addressed by many relevant international institutions, such as: World Bank (WB), United Nations (UN), International Monetary Fund (IMF), among others; (2) the later one is a **very successful approach adopted by many governments around the world**, since 1980's, including the UK Government, where we found many case studies on public administration, and having been its philosophy one of the motivators for ITIL[72] creation; and either, (3) both of them **have similarity with the agile governance phenomena characterization, as well as agile and lean approaches**, in many aspects.

5.3.2 Comparing theories

In keeping with Stoker (1998), theoretical work on governance reflects the interest of the social science community in a shifting pattern in styles of governing. He points out a citation of (Rosenau, 1992), advocating that "*to presume the presence of governance without government is to conceive of functions that have to be performed in any human system... among the many necessary functions, for example, are the needs wherein any system has to cope with external challenges* (the **environmental factors effects [E]**, a construct identified by our theory) *to prevent conflicts among its members* (an example of **moderator factors effects [M]**, another characterized theory unit)*... to produce resources* (chacteristic caught by the **business operations [B]** construct*)... and to frame goals and policies* (for which would be required **governance capabilities [G]**) *designed to achieve them.*" An attentive reader can realize on that citation at least the presence of four out of six constructs that systematize the Agile Governance Theory. This finding indicate a good adherence of the emerging theory with this universal governance theoretical approach.

Stoker (1998) presents five propositions to frame our understanding of the critical questions that governance theory should help us answer, while he recognizes that each proposition implies a dilemma or critical issue, as depicted in **Table 5.28**.

[72] ITIL is one of the most widespread IT Service Management (ITSM) frameworks in the world, i.e., it is a set of practices for ITSM that focuses on aligning IT services with the needs of business, created by UK Government in the 1980s.

Table 5.28 – Comparative analysis between Stoker's view and the emerging theory usefulness. Source: Adapted from Stoker (1998).

Governance as a theory: five propositions by Stoker (1998)	Stoker's dilemma or critical issue	Agile Governance Theory adherence
1. Governance refers to a set of institutions and actors that are drawn from but also beyond government.	There is a divorce between the complex reality of decision-making associated with governance and the normative codes used to explain and justify government.	This aspect is addressed by the delimitation of the organizational context boundary, making clear influences and effects from external [E] and internal factors [M]. There is no need to exist that "divorce", when the agents, factors, and effects from both sides are quite known.
2. Governance identifies the blurring of boundaries and responsibilities for tackling social and economic issues.	The blurring of responsibilities can lead to blame avoidance or scapegoating.	Social and economic issues are factors that can be either from the external environment [E], the organizational inner environment [M]. During theory instantiation, the boundaries delimitation of the "unit of analysis" (organizational context) makes clearer and more effective the analysis of the situation experienced in each context: making the clearest setting for defining responsibilities. Further, communication, feedback and courage [A] combined with accountability and control mechanisms [G] can help to avoid this critical issue.
3. Governance identifies the power dependence involved in the relationships between institutions involved in collective action.	Power dependence exacerbates the problem of unintended consequences for government.	The emerging theory provides a roadmap to outlining and weighing the organizational context in study, as well as its surroundings. Findings from these analysis can create a dynamic scenario where "*a certain amount of autonomy and decentralization can induce to develop leadership capability [G]*", avoiding paralyzing dependencies and guiding executives an teams how to put into practice their overall business strategy.
4. Governance is about autonomous self-governing networks of actors.	The emergence of self-governing networks raises difficulties over accountability.	Agile capabilities [A] (such as "self-organization") when coordinately combined with Governance capabilities [G] (such as "steering ability" and "decision making") promote the development of agile governance capabilities, such as "self-governing". Either, the potential of this scenario can be even expanded by other agile governance capabilities, such as "supervised-autonomy" (i.e., combination of "team's autonomy" [A] and "control mechanisms" [G]) considering the network of actors that comprise the whole organizational environment.
5. Governance recognizes the capacity to get things done which does not rest on the power of government to command or use its authority. It sees government as able to use new tools and techniques to steer and guide.	Even where governments operate in a flexible way to steer collective action governance failure may occur.	Once the executives and teams can become aware about their actuality, they identify any factor which can have harmful effects on organizational context and that could be treated, they identify any gaps in competencies that could be eliminated, or competences that must be developed or encouraged: they can take charge and be able to identify (and respond) to changes, in order to cope with their overall business strategy.

Hence, we advocate that the emerging theory proposed by this thesis is adequately adherent to the five propositions stated by Stoker (1998), and it is addressing and presenting an operative response for every dilemma or critical issue related to them.

Stoker (1998) discusses the Osborne (1993) work in the perspective of how a government might make sensible and effective use of a wider range of tools beyond the direct provision of services. Governance for them is about the potential for contracting, franchising and new forms of regulation, i.e., it is about what many scholars refer to as the **New Public Management (NPM)** (Ewalt, 2001).

While there is much consensus about the nature of NPM, scholars disagree about the normative and positive contributions of NPM. Mathiasen (1999) has called NPM a "paradigm shift" and suggests that innovations occurring abroad have dislodged the bureaucratic model with a new management paradigm.

Lynn Jr (1998) faces the study of NPM as an opportunity to build better theory-based models, and advocates that the "*logic of governance*" embodied in NPM practices, which he sees as a "*dynamic, interactive, and continuous sociopolitical process that induces the performance of public programs and mediates the consequences of particular strategies for change or reform of government activities*". Similarly, in both governance and NPM, "steering" is a key concept. In turn, Min and Weidong (2005) points out four characters of NPM, depicted in **Table 5.29**.

Therefore, we can imply the emerging theory, agile/lean approaches, and NPM are based on very similar premises, values and principles. Whether NPM represents a new paradigm or not, its attempt to transform the public sector through organizational reforms that focus on results in terms of efficiency, effectiveness, and quality of service appears to fit nicely into the larger, political theory of governance (Stoker, 1998). We also found many references related to NPM in our systematic review, pointing out NPM as a tendency in lean government [S16], [S93], [S128], [S147], [S162].

In fact, Ewalt (2001) highlights that, as pointed out by Peters and Pierre (1998), **governance** is a *political theory* while **NPM** is an *organizational theory*. Peters and Pierre (1998) claims that governance is about *process*, while NPM is about *outcomes*, as well as we advocate that our theory is about how to assist executives and teams to become aware about their actuality, in

order to define the means by which (e.g., *processes*, practices, etc.) they can generate *outcomes* that lead them to cope with their *overall business strategy*.

Table 5.29 – Comparative analysis between New Public Management (NPM) characters and the emerging theory approach. Source: Adapted from Min and Weidong (2005).

New Public Management (NPM) characters	NPM under the lens	Agile Governance Theory adherence
1. Efficiency and quality of public service	Traditional public administration pays attention to input and process, while new public management stresses on output and result, especially on individual achievement and institution achievement. Thus new public management requires the definite criterion set by public sector and makes systematic survey on achievements of public sector and staff with that criterion.	Quick wins (central keystone of the fourth theory meta-principle), cooperation, and teamwork are central concepts of the emerging theory. In addition, according to **Table 3.4**, "*agile governance is more about behavior and practice than... process and procedures*". This aspects guide executive and teams to achieve quality and service efficiency. This character is quite aligned with our theory canons.
2. Customer orientation	On the view of new public management, government staff is conscientious enterprise managers and manager handlers; while social public are consumers or customers. Government service should be Customer Oriented to enhance the response ability to public needs. New public management use so many modes such as customer investigation, customer visiting, community investigation and customer contact to solicit the public opinion and request of public service and then survey their satisfaction.	As to overall agile methods, the emerging theory advocates that the "teams' highest priority is to satisfy the customer through early and continuous delivery of value", and be close to the customer, understanding their needs and desires is the best way to do this. This character is also closely aligned with our theory. In order to operationalize that principle, our theory applies the concept of value delivery [R] that goes beyond the product or service delivery, worrying about the beneficial realized by the customer.
3. Decentralization and miniaturization of department	By referring to new public management theory, many government sectors set up execution departments or separate departments with half autonomy. Those departments take charge of the implementation of public projects and providing of public service. The feature of decentralization is that it can reduce the bureaucracy size and centralization degree.	The theory sixth meta-principle states "simple design and continuous refinement", i.e., teams must deliver fast, and must be always improving. Enterprise architecture is directly related to this issue, and it is also a factors that should be addressed in order to avoid become a moderator factor [M] of the organizational context.
4. Competition mechanism	According to new public management theory, there are many virtues in competition mechanism. Firstly, it can improve efficiency and use less input to get more output. Secondly, it can break monopoly and force the monopoly department to meet the customers' needs to realize the consumer sovereignty and public sovereignty. Moreover it can encourage reform to inspire the creativity of civil servants and enhance their proper pride and morale. In a word, new public management wants to use the competition mechanism to break the monopoly of public service in public sectors for the sake of efficiency and quality of public service.	The Manifesto for Agile Software development (Beck et al., 2001) claims that we should to build projects around motivated individuals, as well as we should give them the environment and support they need, and trust them to get the job done. In spite of the theory's first meta-principle states "the business must be the reason for every decision and action", our second one harmonizes"people must feel valued and incentivized to participate creatively". Competition guided by those principles can be used as a trigger to activate and develop responsive capability in team members.

On the other hand "good governance" is a term that has become a part of the vernacular of a large range of development institutions and other actors within the international arena. Rachel Gisselquist (2012) highlights the problem of conceptual clarity when it comes to "good governance" and why this is problematic for the practical outcomes that development institutions and the like are trying to achieve.

According to Drake et al. (2001), the World Bank's ***"good governance"*** agenda is concerned with "*the relationship between the state, the market, and civil society in loan-receiving countries*." The ideal of the 'minimalist state' has been replaced with that of the 'effective state'. The Bank argues that "*in order to be effective, the state must play a critical role in managing and regulating the market and civil society*".

However, Bang and Esmark (2013) highlight that the notion of good governance does not refer to a scientific theory of governance, or governance as a research program. According to them, good governance refers to "*an empirically observable politico-administrative way of making public policy-making, reforming and organizing*".

Drake et al. (2001) also discusse that, in theory, the "good governance" agenda marks a watershed in the WB, IMF and UN approaches to the role of the state and institutions. The 1997 World Development Report, The State in a Changing World, acknowledges that the state has a critical role to play in promoting development, in direct contrast to its pro-market policies of the 1980s. The report envisages the state "*not as a direct provider of growth but as a partner, catalyst, and facilitator*" (World Bank, 1997).

Bang and Esmark (2013) points out that, setting aside for now its many local variations, however, the overall strategy of good governance can be seen as a set of guidelines for politico-administrative practice in three relatively distinct ways. First and foremost, "*it is a particular thinking about how to govern*", or simply how to conduct public governance. But "*it is also a political agenda, i.e. a particular set or even hierarchy of policy issues*", as well as a way of framing these issues. Finally, "*good governance involves particular stances and notions about the organizational reform of the public sector*". Hence, good governance covers three basic politico-administrative domains: public governance, policy and organization.

United Nations Development Programme (UNDP) published in 1997 a policy document named "*Governance for sustainable human development*", in which they have pointed nine

characteristics of Good Governance. **Table 5.30** depicts each one of these characteristics, for which we discuss the adherence of the emerging theory.

Table 5.30 – Characteristics of Good Governance. Source: Adapted from (UNDP, 1997).

Characteristics of good governance	Agile Governance Theory adherence
1. Participation: All men and women should have a voice in decision-making, either directly or through legitimate intermediate institutions that represent their interests. Such broad participation is built on freedom of association and speech, as well as capacities to participate constructively.	Our theory makes no distinction whatsoever (sex, race, religion, economy class, etc.). In addition, when our 2nd meta-principle states "*the business must be the reason for every decision and action*", in the context of governments and nations, the core-business that should drive any action should be initiatives to accomplish the welfare of their citizens (greater good for society). In complement, our 3rd meta-principle advocates that "*people must feel valued and incentivized to participate creatively*". So, this character is quite aligned with our theory canons.
2. Rule of law: Legal frameworks should be fair and enforced impartially, particularly the laws on human rights.	"*To ensure regulatory compliance status of business operations*" is a key dimension of Governance capabilities [G], a core-construct of the emerging theory. Likewise, values such as "*mutual trust*" and "*honesty*" are are part of the core of agile and lean philosophy, from which we derive our approach.
3. Transparency: Transparency is built on the free flow of information. Processes, institutions and information are directly accessible to those concerned with them, and enough information is provided to understand and monitor them.	According our meta-values (see **Table 3.4**), agile governance "*is more about transparency and people's engagement to the business... than... monitoring and controlling*". Likewise, values such as "*transparency*" and "*feedback*" are are part of the core of agile and lean philosophy, from which we derive our approach.
4. Responsiveness: Institutions and processes try to serve all stakeholders.	According our meta-values (see **Table 3.4**), agile governance "*is much more about sense, adapt and respond ... than... follow a plan*". In addition, that capability is into the core of agile governance phenomena characterization, as depicted in the phenomena concept, from which we brought an excerpt: "*is the ability of human societies to sense, adapt and **respond rapidly** and sustainably to changes in its environment...*"
5. Consensus orientation: Good governance mediates differing interests to reach a broad consensus on what is in the best interests of the group and, where possible, on policies and procedures.	As we already have mentioned for the first characteristic of good governance, our 2nd meta-principle states that "*the business must be the reason for every decision and action*", in the context of governments and nations, the core-business that should drive any action should be initiatives to accomplish the welfare of their citizens (greater good for society).
6. Equity: All men and women have opportunities to improve or maintain their well-being.	This characteristic is quite closely related to theory 3rd meta-principle, already depicted on this table.
7. Effectiveness and efficiency: Processes and institutions produce results that meet needs while making the best use of resources.	The emerging theory advocates that results must be expressed not only by delivery of products and services (which are outcomes from business operations [B]), but mainly by the persistence of the benefits arising from them (value delivery [R], e.g., customer satisfaction, business efficacy, humanitarian aid, welfare of citizens), for a large spectra of audience that depends on every core business, such as: shareholders, customers, employees, partners, suppliers and societal. Besides, effectiveness and efficiency are means by which is achieved the organizational competitiveness, a system state of the theory.
8. Accountability: Decision-makers in government, the private sector and civil society organisations are accountable to the public, as well as to institutional stakeholders. This	Accountability is a dimension of the Governance capabilities [G], and it is considered a key competency to ensure strategy accomplishment on business operations (e.g., establishing mechanism, policies, accountability) as well as even more essential to guarantee the achievement of the objectives of the

Characteristics of good governance	Agile Governance Theory adherence
accountability differs depending on the organisations and whether the decision is internal or external to an organisation.	organization and its projects. In addition, the 1st meta-principle of the theory establishes that "*the level of governance must always be adapted according to the organizational context*".
9. Strategic vision: Leaders and the public have a broad and long-term perspective on good governance and human development, along with a sense of what is needed for such development. There is also an understanding of the historical, cultural and social complexities in which that perspective is grounded.	The emerging theory claims that when the executives, managers or leaders are coordinating teams, they must continuously influence their behavior, defining, spreading and sustaining an oriented strategic vision. This vision oriented must be strategically built to achieving the goals and business needs, as well as it be shared as a collective property with all staff. It is important to transmit it in consideration of the team always has the big picture. This vision must always be widespread, updated and preserved from internal or external agents to the team.

As a consequence of the **Table 5.30** elaboration, we advocate that the emerging theory is properly adherent to the nine characteristics established by United Nations Development Programme (UNDP).

Moreover, Magno and Serafica (1997) discuss that advances in IT offer potentially beneficial effects on governance. For instance, the increased performance and availability at reduced cost of microelectronics, fiber optics, voice and video compression, fast-packet switching and high-density storage technology could be utilized to make public administration more efficient, e.g., for the low cost provision of public services such as health care and education.

According these authors, IT can promote ***good governance*** in three basic ways: (1) by increasing transparency, information, and accountability; (2) by facilitating accurate decision-making and public participation; and (3) by enhancing the efficient delivery of public goods and services. The citizen's right to gain access to public documents is supported under the country's constitutional framework. Promotion of this right is pursued through the government's computerization program and the availability of these documents through the Internet. Many government agencies use IT facilities to tell the public about their accomplishments, achievements, programs, and plans.

We can imply that those contributions of IT on *Good Governance* agenda can also be extended to the *New Public Management* approach, because, in short, they have similar scope of action. While either Good governance and NPM provide general guidelines to achieve their aims (whether state or government), they do not address details how to do that. Actually, we can realize that there is a gap between the overall strategy proposed by those "governance approaches" and the real practice.

Notwithstanding, we can suggest that the operationalization of those IT contributions can be achieved by frameworks and guides such as ITIL (Cartlidge et al., 2007; OGC, 2007a) and COBIT (ISACA, 2012), which are the two most widespread and recognized frameworks related to IT governance, they seem not be enough to fulfill this goal. Indeed, we found many evidences [S5], [S28], [S60], [S62], [S90], [S96], [S99], [S150] on the findings of our systematic review (Luna et al., 2014b) pointing out that "*the available* governance practices, models, guides and frameworks are *most of them bureaucratic, time consumer and having no guidance details of how to implement and deploy the necessary management instruments and governance mechanism*".

Table 5.31 – Exemplifying how Agile Governance Theory can address the operationalization of IT contributions. Source: Adapted from Magno and Serafica (1997).

IT contributions to promote good governance	Agile Governance Theory
(1) by increasing transparency, information, and accountability.	Fostering and developing agility at the business level combining capabilities, such as flexibility, responsiveness and adaptability [A], upon governance capabilities [G], such as policy making, decision making, accountability, control and responsibilities; generating as result, new and innovative approaches such as: agile policy making [S153], agile decision making [S131], lean public services [S93].
(2) by facilitating accurate decision-making and public participation; and	For instance, creating mechanisms to facilitate a "participatory decision making process", by means of the coordinated combination of Agile capabilities [A] (e.g., cooperation, self-organization, responsiveness) and Governance capabilities [G] (e.g., decision making, strategic alignment, control).
(3) by enhancing the efficient delivery of public goods and services.	Recognizing that the organizational mission does not finish when the business operations [B] deliver products or services. In fact, after business operations [B] have provided their outcomes, it is indispensable assuring the **value delivery [R]** of these outcomes to the audience, which behaviorism is described by the **Law 6**, detailed in Section **4.3.2.6**. In the emerging theory the value delivery [R] comprises of three dimensions: (i) **utility**: whether the outcomes are fit for purpose; (ii) **warranty**: whether they are fit for use; (iii) **time-to-market**: whether they are available at the right time, in the right place, to the right people.

At this point, we can infer that the proposition of the emerging Agile Governance Theory is a welcome contribution to help to reduce that "gap", in order to operationalize the aforementioned IT contributions, in either of these two approaches. **Table 5.31** depicts some instances how Agile Governance Theory can address the operationalization of IT contributions in context of Good Governance and New Public Management.

5.4 Supplementary Theory assessment

This subsection deals with the evaluation of the emerging theory against the Glaser's criteria (Glaser, 1992) to evaluate the theory's *credibility* and Angen's approach (Angen, 2000) to conduct a validation from the *ethical* and *substantive*[73] perspectives, as well as Sutton and Straw's (1995) critical view about what is not theory.

Despite these theory evaluation approaches are more widely employed in theories produced using the method of Grounded Theory (GT), because we have adopted some GT techniques to the theory emergence, we believe that those evaluation approaches can reinforce the scrutiny of the emerging theory giving even more consistency to the theory building approach.

5.4.1 Glaser's approach

Glaser (1978, 1992) suggests evaluating the ***credibility*** of a theory through four criteria: ***fit, work, relevance,*** *and* ***modifiability***. A *core category*[74] that fits, works, is relevant, and is subject to continual modification, will integrate a theory in the way that the theory is dense and saturated with relationships. The emergent conception that fulfilled this role for theory core was "*coordinated combination* of *agile/lean and governance capabilities as a key for organizational sustainability and competitiveness*", simply conceptualized as "*agile governance*".

In this study, we started reading extensive literature from the substantive and correlated areas, commencing the research study (Section 2.4.1). This first investigation gave us a better understanding which were the next steps for the ongoing research, and mainly where we should find what we are looking for (theoretical sampling). After that, our knowledge on the key concern of agile governance phenomena was primarily acquired through interaction with scholars and practitioners from social networks related to governance and agile/lean practices, while collecting data from them (Section 2.4.2).

We particularly employed theoretical sampling, in which the decisions on what data to collect and where to find them were determined based on the emerging theory. We managed to select

[73] A substantive approach to validation indicates researchers need to document the chain of interpretations in order for others to judge the trustworthiness of the meanings arrived at in the end (Angen, 2000).

[74] On Grounded Theory approach the *core category* turns out to be the research problem for the phenomenon being studied within its context (Glaser, 1992).

suitable participants from different roles across different organizational context in different countries who provided us with relevant explanations on the emerging theory from different perspectives. As a result of this increased understanding of the phenomena, we have selected some representative agents of the phenomena under study for further data collection through semi-structured interviews (Section 2.4.3). We also continually changed the interview questions in order to focus on the concerns that seem central to the emerging theory. Theoretical sampling was continued until complete redundancy, or theoretical saturation, was noticed in the new data. In fact, this was the criteria that lead us to stop interviewing process (theoretical saturation). Therefore, the categories and their properties which define the theory have only emerged from the data, although we cannot ignore that we had some preconceived ideas based on our own previous experience about this theme. However, those ideas were not the drive force of our research, but data were, because even some of those ideas were discarded during the study trajectory. Hence, we argue our theory ***fits*** the realities under study.

One way to find out the "***work***" and "***relevance***" of the theory is to ask the participants whether the theory elements relates to the problem in the area studied and the theory explicates the pattern of behaviour used to address the problem. Even during our interactions with scholars and practitioners on professional social networks observation and semi-structured interviews, after formal procedure of data collection, i.e., after carried out the interview (off-record), or even after close a topic on the social network (inbox). We have received very good feedback about the perception and understanding about the ongoing work. For instance, one of those feedback is depicted as follows:

> "*Your work is very interesting! This care that you had to do with the external environment and internal environment, I think this is essential in your research. I liked when you started talking about the external environment (boundaries), internal environment, the constructs, interactions among them... I thought to myself: that is so cool! Because this is something real in organizations... and many leaders... ignore it, or forget it. Then just when you have a concern, I mean, a leader who has this concern... I think that with the agile governance he or she can be differentiable from that guy who just ignores and when the thing 'blow-up'! ...he or she 'goes after something' to solve problems that were ignored... And it already is too late!*" - IT07, Research and practitioner on Software Project Management.

When as theory components (constructs, laws, boundaries, system states, propositions, empirical indicators, and hypotheses) emerged from data analysis, we attempted to write technical papers explaining the emerging theory. Follows an excerpt of the written feedback received from some conference reviewers:

- *"In the paper a theory to characterize agile governance is presented. The theory has been built with rigor by following the method by Dubin. The theory building also is based on an extensive review and as a result the relevant works in the area of agility and governance have been considered. The other positive point of the work is that by means of the proposal a suitable conceptualization is provided and the resulting theory can involve homogeneization in future directions of research in the area."* - Reviewer from the 12th Workshop on Experimental Software Engineering (ESELAW 2015) and Iberoamerican Conference on Software Engineering (CIBSE).
- "*Work is well grounded, it has a well-defined method and addresses an issue of great interest*." - Reviewer from the Brazilian Conference on Software (CBSoft 2014).
- "*Research addresses a relevant problem, it is well organized and written, and technically sound. Very good work*!" - Reviewer from the 12th International Conference on Management of Technology and Information Systems (CONTECSI 2015).

Subsequently, we published these technical papers and presented them at international conferences (see Section 6.4.1). To date, we have presented different aspects of the emerging theory to the participants and the wider Agile community at various conferences. We have received continual feedback from practitioners describing how the emerging theory has been useful, meaningful, and applicable to them.

Also, during the explanatory survey carried out to test the theory hypothesis, we also have argued to the respondents about how they evaluate this research contribution for industry and academy, in a ordinal scale of 10 points, obtaining as result a mean of ($\bar{x} = 8.14$; $\sigma = 1.87$), which puts our research at a level that means: *"I very agree that ongoing research is a necessary contribution to industry and academy*".

For that reason, we argue that the emerging theory ***works*** and is ***relevant*** for practitioners working in related area. Our theory has evolved over time when we compared new data to the existing concepts and categories. For instance, during data analysis, some insights were assimilated, such as: the frequent difficulty to determine the boundaries of the *organizational context* by the team members and even by experienced managers and executives.

In addition, when we carried out the explanatory survey, we have realized how the particularity of each context influences the efficacy of some empirical indicator (manifest variables), adopted to measure the theory constructs (latent variables), in order to analyze each theoretical scenario depicted. Thence, we believe our theory can still continue to evolve when new relevant data is compared to the existing theory. Therefore, we argue our theory is readily ***modifiable*** when new data present variations in the emergent substantive codes.

5.4.2 Angen's approach

In this work, we have also adopted Angen's (Angen, 2000) validation approach for interpretive, qualitative research adopted to the phase one of this research (theory emergence, **Figure 2.1**): *ethical validation* and *substantive validation*. We have focused on validation when research is formulated, carried out and written up. Thereby, we have adopted a systematic set of explicit procedures for collection, analysis, and articulation of conceptually abstract theory.

In order to achieve ***ethical validation***, we have considered ethical issues such as confidentiality, rights of the subject research, consentiment formalization to participate of the research (to name a few), in any data collection procedure carried out during the research.

For instance, participation in our study was always entirely voluntary and the invited subject could have refused to participate or could have withdrew their data from the study at any time, before the completion of the data collection procedure (interview, survey, etc.). Further, we have gathered the formal consentiment from subjects (either through audio record, or consentiment form signature), which indicate their consent and support for our study on behalf of their organization, as well as their organization's permission for the use of the provided data to the aims of this study. In addition, we have selected, contacted and we have disclosed contact information of the Secretary of the Board of Research (SEC-DPQ) in the UFPE Office for

Research Affairs and Graduate Studies (PROPESQ), to act as arbitrator in the case of any inquiry or a complaint by the research participants.

In spite of we have done a major upfront literature review about the state of art of the agile governance phenomena (Section 3.7), and we have had our own beliefs and preconceived ideas about some mecanisms related to the phenomena under study, our *professional experience* and "*imaginative discipline*" have allowed us keep focus on the data during theory emergence, avoiding generating a focus from the literature rather than from the data. In fact, that literature review was very useful in order to help us to understand the amplitude, depth and the multidiscipinary nature of the phenomena envolved. Likewise, we have integrated gradually the literature into the emerging theory through the data analysis process during the whole theory building cycle.

Also, we have used some techniques from Grounded Theory processes from inception to completion of the theory emergence, employing theoretical sampling until we have reached theoretical saturation, and continually wrote theoretical memos (took note: on the codes, concepts and categories) in order to develop a conceptually dense theory (Section 2.2.2). However, we have finally performed theoretical sorting in order to write up and format the emerging theory using the Dubin's quantitative method of theory building for applied disciplines (Section 4.3).

In this thesis, we included selected evidences from different data sources (quotations from: interview, professional social networks, and literature review) throughout the results chapters in order to describe how the categories and their properties emerged from data analysis (Section 4.3). Also, we have included a detailed description how the codes, concepts and categories that emerged from data analysis in order to document evidence on how the theory was developed in this research (Section 2.5.1). Further, we have presented a sample for each nomological network depicted, regarding every theory unit (construct) in order to legitimate their validity (Section 4.3.1), and therefore, all work derived from them.

Moreover, we have conducted an explanatory survey to assess the theory plausibility, obtaining the participation of 281 scholars and practitioners who match the respondent profile established (Section 5.2.1.5) in order to characterize them as a representative agents from the phenomena under study. As a consequence, we have carried out an extensive analysis from

those data, employing CFA and SEM, in consideration to test the hypotheses derived from the emerging theory (Section 5.2.2).

Hence, in order to achieve ***substantive validation***, we advocate that we have provided adequate description pertaining the research for others to judge the trustworthiness of the meanings arrived at in the end.

5.4.3 Sutton and Straw's critical view about what is not theory

According to Sutton and Staw (1995) there is little agreement about what constitutes strong versus weak theory in the social sciences, but there is more consensus that references, data, variables, diagrams, and hypotheses are not theory. These authors wrote a paper entitled "What theory is not" in 1995, in order to help authors avoid some of the most common and easily averted problems that lead readers to view papers as having inadequate theory.

They also point out that detailed descriptions of what theory is and the distinctions between strong and weak theory in the social sciences can be found, for example, in Dubin's (1978, 1976) analysis of theory building in applied areas, Freese's (1980) review of formal theorizing, Kaplan's (1973) philosophical inquiry into the behavioral sciences, Merton's (1967) writings on theoretical sociology, and Weick's (1989) ideas about theory construction as disciplined imagination.

In short, Sutton and Staw (1995) even consider five features of a scholarly article that, while important in their own right, do not constitute theory. We have used these features to analyze critically our theory.

Therefore, we advocate that the emerging theory proposed by this thesis is not threatened by any of these five features established by Sutton and Staw (1995), and it can be classified as a ***theory for analysis and description*** (Type I) according to (Gregor, 2006). In other words, Agile Governance Theory provides a description of the phenomena of interest (agile governance), analysis of relationships among those constructs, the degree of generalizability in constructs and relationships and the boundaries within which relationships, and observations hold.

Table 5.32 – Theory critical analysis based on Sutton and Staw (1995) view. Source: Adapted from Sutton and Staw (1995).

Five features from Sutton and Staw (1995)	Agile Governance Theory scrutiny
References are not theory	In order to develop the current theory we have used extensive amount of references from many and distinct sources, such as: systematic review, observation on professional groups based on social networks, semi-structured interviews with representative agents of the phenomena under study, exploratory literature review, and even analysis of reports and technical documents. However, these references are only the insumes (inputs) to the process of phenomena understanding, as well as identification of the elements to build and assess the emerging theory .
Data are not theory	Massive quantity of data were collected during the theory building and assessment process: more than 200 primary documents into tool analysis repository, 167 papers were selected from by our systematic review, we gathered ten audio records from interviews, survey data from 281 questionnaires, among others. However, these data were just a stage of the theory building process, and their analysis in deep allowed us to generate: more than thousand quotations, associated to 458 codes, creating dozens of network views and memos (depicting the relation among codes), comprising sixteen agile governance categories organized in four major groups, among other elements.
Lists of variables or constructs are not theory	From those findings, our "disciplined imagination" framed by theoretical lens of Dubin (1978, 1976) has allowed us to identify and characterize six theory units (constructs or latent variables), six laws describing their interaction, delimiting theory boundaries and identifying its unit of analysis (organizational context and its instantiations), as well as seven macro-states and five system states of the theory organized into two detailed state machines, in addition to eight theoretical scenarios where the theory can take place, to cite few of the theory elements.
Diagrams are not theory	Those elements were extensively illustrated by means of diagrams, figures and graphics, in order to give a better understanding of the emerging theory, surrounding phenomena and how it can link to the real world. For instance, originally we have produced more than 40 figures, just in the Chapter 4, which details the emerging theory, of which we can mention the figure that depicts the *Conceptual Framework* of the theory (see **Figure 4.12**). Nevertheless, these illustration are not the theory! Indeed, they are snapshots from theory views, as images from a *kaleidoscope*, i.e., they were provided with the aim of enable to the reader interpret theory and use it in their own context and actuality. However, rich explanations about every illustration were made available, including connection among them were provided.
Hypotheses (or predictions) are not theory	During the research operation and theory operationalization, we have identified 11 propositions, 24 empirical indicators (manifest variables) to measure the theory units (latent variables), and 16 hypotheses to test. In order to assess the theory plausibility we have conducted an empirical study by means of an explanatory survey inviting 956 representative agents from the phenomena under study, and the findings of this study points out to theory verisimilitude, although still many other studies will be necessary to discuss theory in terms of trustworthiness. However, none of these elements are the theory! Indeed, the theory is the system described by those elements together with the relationships between their objects and between their attributes, and how those parts work together in order to achieve a common goal (deliver value faster, better, and cheaper to the business), where the whole is more than the sum of parts.

5.5 Theory assessment conclusion

Regarding to the emerging theory ***internal validity*** we can recover from Section 4.3.1 the development of nomological networks Cronbach and Meehl (1955) for every theory unit in

order to establish views of construct validity. Further we discuss extensively how each construct has emerged from the analysis of distinct data sources in a specific Section (with the same name) depicted for each theory unit. From the operationalization of the theory we have tested 16 hypotheses related with 11 propositions and we have confirmed hypotheses related to the *key constructs* ([A], [G], [B], [R]) and *core assumptions* of the emerging theory, including the coherence of the agile governance concept, characterization and differentiation between agile governance approach and specific agile approach, as well as 1st, 2nd and 6th Laws of interaction, and theory's premises in all the theoretical scenarios depicted by the theory by means of an empirical study. Despite Glaser (1992) states that validity of the emergent theory may be undertaken by another researcher using different research methods, we have assessed the theory credibility by Glaser's approach, using four criteria – fit, work, relevance, and modifiability – as criteria for quality judgement. Also, we have adopted Angen's (2000) validation approach for interpretive, qualitative research – ethical validation and substantive validation – for the validation of our theory.

Concerning to ***generalizability*** of the findings, we have some limitations related to the survey sample comprised in its major amount (87.3%) by "typical cases". Indeed, this sample representativeness means that we can compare the findings from this study using typical case sampling with other similar samples (i.e., comparing samples, but not generalizing a sample to a population). Therefore, with typical case sampling, we cannot use the sample to make generalizations to a population, but the sample could be illustrative of other similar samples (Patton, 1990). In addition, because we have used some techniques from Grounded Theory we inherit some limitations of the method, i.e., we often encounter criticism on literature regarding the generalizability of the findings when we employ this method. A Grounded Theory research study produces a "mid-range" theory, which means the theory can be modified with further analysis using new data from the same context or new context. Although, during theory comparison we found indications of the potential of the emerging theory when applied in broader contexts, such as public or global governance (see Section 5.3.2), we do not claim our findings are universally generalizable to different contexts. Our findings, however, accurate characterize the contexts studied: IT Governance. However, further and accurated studies might shift theory scope, extending its application and usefulness.

Respecting to the ***theoretical level of the theory building***, Eisenhardt (1989) states that tying emergent theory to existing literature enhances the internal validity, generalizability, and

theoretical level of the theory building. During the theory building process we have linked results to the literature with the emerging theory continuously in many stages, and once new relevant literatures were identified, we have sought for further corroboration or faced points of reflexive attitude in order to refining the emerging theory and improve the theoretical level of the theory building. Using the same rationale, we can also imply that because we have used many distinct theoretical sample sources, we have increased the theoretical level of the emerging theory.

5.6 Closing remarks

In this chapter we have designed and conducted an empirical study to assess the theory plausibility, by means of the hypotheses testing of the eight theoretical scenarios depicted from theory described and operationalized in Chapter 4, and Modeled by Structural Equations (SEM).

The findings of this study explanatory survey points out to theory *verisimilitude*, confirming the hypotheses are related to the key constructs and core assumptions of the emerging theory in every theoretical scenario. Although, these results are promising, still many other studies will be necessary to discuss theory in terms of *trustworthiness*. We also realized many lessons learned, in order to refine and expand future studies in that aim.

This chapter also has compared the emerging theory with two other theoretical approaches and concluded that the Agile Governance Theory is properly adherent to them, as well as it is a welcome contribution to help to reduce the gap between the overall strategy proposed by those “governance approaches” and the real practice, in order to operationalize the IT contributions.

In complement, in this chapter we further evaluate the emerging theory against the Glaser’s criteria to evaluate the theory’s credibility and Angen’s approach to conduct a validation from the ethical and substantive perspectives, as well as Sutton and Straw’s critical view about what is not theory. As a consequence, theory was positively assessed in every criteria, and it can be classified as a theory for analysis and description (Type I) according to Gregor (2006).

Finally, theory’s internal validity, generalizability, and theoretical level of the theory building were discussed.

Chapter

6

6. Conclusion and perspectives

This chapter aims to discuss final thoughts on the main topics covered in this thesis, including the achieved contributions, research limitations and directions for future work.

6.1 Overview

This chapter presents the conclusions and recommendations of the thesis, considering emerging contributions for academy and industry, outlined from the methodological procedures used during all stages of this research, and from the statistical results of the empirical study carried out to assess the emerging theory. In the following Sections, we also summarize Agile Governance Theory, discussing how the emerging theory answers the research questions, suggesting how people can get the best of the theory. Then, we compile the research contributions, discuss its limitations and, finally, we suggest some topics that can be organized in an agenda for further research and insights that can be explored in forthcoming inquiries.

6.2 Conclusions: analysis of the research goals

The initial motivation of this research was to reach a better understanding of the agile governance phenomena and shed some light on the organizational contexts in which they occur. From the assumption that once the agile governance phenomena can be better understood in their nature, as well as their constructs, mediators, moderators and disturbing factors might be mapped, these elements systematized by means of an theoretical approach could help organizations to achieve better results in their application: reducing cost and time, increasing the quality and success rate of the agile governance practice.

In order to achieve that level of understanding of those phenomena, we (1) have developed a systematic literature review (SLR) about the state of the art of agile governance, complementing SLR findings with (2) an observational approach of social networks related to the topic in study, and (3) having conducted some semi-structured interviews with representative agents of the phenomena in study. Ergo, we (4) have developed a theory of agile governance framed by Dubin's method of theory building research, encompassing its constructs, laws of interaction, boundaries, and system states. As a consequence, we (5) have operationalized the emerging theory: specifying its *propositions*, identifying *empirical indicators* to measure its constructs, developing *hypotheses*, and building a *research agenda* to test the theory.

As the next step, we (6) have conducted an empirical study based on explanatory survey, obtaining 118 valid cases for statistical analysis and having a broad geographical coverage, from representative agents related to the phenomena under study. Then, (7) we carried out an *Exploratory Factor Analysis (EFA)* to study the structures underlying the manifest variables and their relationship with the six latent variables of the theoretical model derived from that emerging theory. This procedure was followed by a (8) *Confirmatory Factor Analysis (CFA)* to evaluate the measurement sub-model, and verify the goodness of fit of the theoretical models, related to the correlational structure of manifest variables from the data sample collected during the study. After that, we have applied (9) *Structural Equation Modeling (SEM)* approach in order to test the proposed hypotheses for each of the eight *theoretical scenarios* depicted from emerging theory. Correspondingly, SEM results point out the plausibility of the theory components and hypotheses.

In complement, (10) we have conducted theory comparison contrasting two other alleged theories with the emerging theory, to examine what is similar, what is different, and why, in order to enhance the internal validity, generalizability, and theoretical level of the theory building.

Also, (11) we have further assessed the emerging theory against the Glaser's criteria to evaluate the theory's credibility and Angen's approach to conduct a validation from the ethical and substantive perspectives, as well as Sutton and Straw's critical view about what is not theory. As a consequence, theory was positively assessed in every criterion, and it can be classified as a theory for analysis and description (Type I) according to Gregor (2006). The overall findings of this research points out to theory *verisimilitude*, although still many other studies will be necessary to discuss theory in terms of *trustworthiness*.

Concerning the **thesis assumption** (Section 1.3), a theory to analyze and describe agile governance was developed, and many evidences were gathered and their analyses lead us to infer that this theory can help people and enterprises to achieve better results in their application: reducing cost and time, increasing the quality and success rate of their practice. However, further studies must be developed to confirm this assumption.

In relation to the **research objectives** (Section 1.4), we have provided a better understanding of the agile governance phenomena, we have identified what are the elements that influence business performance, and we have described how those elements interact with each other.

We also reached the following achievements: (1) advancing in state of the art of agile governance; (2) framing the understanding achieved for the agile governance, by means of a theory to analyze and describe its phenomena; and, (3) assessing the emerging theory plausibility.

Regarding the **research questions** (Section 1.1), we can claim that we have answered all those questions: (RQ1) we have characterized and conceptualized agile governance and we have provided a theory to analyze and describe its phenomena (Chapter 4); (RQ2) we have identified the necessary elements to do that (e.g., constructs, boundary-determining criteria, system states, etc.) (Section 4.3); (RQ3) we have proposed laws that describe how those elements interact with each other (Section 4.3.2); (RQ4) we have developed a conceptual framework of the theory describing and analyzing the theory as a system (Section 4.3.5); (RQ5) we have derived from the emerging theory the system behavior description, as well as a set of propositions and hypotheses (Section 4.4); (RQ6) we also framed the emerging theory by Dubin's quantitative method of theory building for applied disciplines, through eight steps and dozens of scrutiny criteria, as well as we carried out a critical analysis of the theory by the lens of Sutton and Staw (1995) (Section 5.4.3); (RQ7) we depicted eight scenarios from the emerging theory that help to characterize and describe organizational contexts in the real world (Section 4.5.3); (RQ8) we have assessed the emerging theory by means of an empirical study (Section 5.2), by comparison and contrast with other theories, plus by Glaser's (1992) criteria, Angen's (2000) approach, and even by Sutton and Straw's (1995) critical view (Section 5.4); (RQ9) we have provided a specific Section (4.6) about theory application, presenting a set of guidelines and tools to put the emerging theory into practice and discussing the main strategies.

Further, during our Explanatory Survey (APPENDIX VI.3), we also have asked to the representative agents related to the phenomena under study how much they agreed with the following statement "*the development of a theory for extend the understanding about agile governance phenomena is a necessary contribution for industry and academy*". In fact, more than 83% of the respondents have agreed that this research is a necessary contribution for industry and academy. **Figure VI.14**, at the APPENDIX VI.4, depicts the answer profile for that question. This evidence is an indication of the existing receptivity, as well as of the "pent-up demand" related to the type of contribution brought by this research, for a young field of study, in need of such initiative.

6.3 Agile Governance Theory: summary, usefulness and adaptability

Based on the aforementioned research steps, since we were better understanding the agile governance phenomena and its multidisciplinary nature, it became clearer to us how to propose a theoretical approach to analyze and describe these phenomena. We kept in mind that this approach should allow executives and teams to become aware of their actuality, as well as address their overall business strategy, giving them an adaptive and reflexive reference to find their own way toward maximizing delivery of business value.

Traditionally, exogenous factors refer to variables outside the control of an organization. Analyzing the agile governance phenomena, we realized a set of environmental factors that were conceptualized by the construct [E], as exogenous factors, in most of the theoretical scenarios depicted by the emerging theory. The factors represented by this construct cannot be neglected when defining and evaluating the strategy of a company, as well as the mechanisms to ensure its accomplishment.

Furthermore, the analysis of those factors are closely dependent upon a clear delimitation of the organizational context boundaries, e.g., which may be a priority for a context may be less relevant to other.

Under these circumstances, we also noticed the existence of factors that exert, over organizational context, a kind of effect which opposes the organizational performance, that may in many cases have inhibitory or limiters influences. These effects were designated as moderator factors [M], an endogenous construct, which cannot be fully considered independent of the same boundaries that delimit the organizational context. Indeed, [M] conceptualizes the effects sensed by the organizational context as a result of the influence caused by the inner moderator factors forming part of this context.

In complement, there are faculties that executives and teams can acquire and develop in order to cultivate, apply and evolve competencies that can reduce the negative influences, as well as enhance the eventual positive influences from [E] and [M]. In the scope of the phenomena under study, these *dynamic assets* are focused on agile/lean [A] and governance [G] capabilities. These capabilities are even more valuable when coordinately combined to increase

their effect on [E] and [M], and mainly to intensify an increase the level of the business operations [B], conducted for the purpose of generating value delivery [R].

These short wording represents a brief characterization of the dynamic system that the emerging theory uses to analyze and describe agile governance and their phenomena (See Chapter 4 for entire description). The system described by those constructs, its interactions, boundaries, system states, and other elements, can be considered “remarkably obvious”. This can lead some scholars to claim that we are considering organizations as “naive organisms”, as well as their executives and teams, the relationships between their distinct parties involved and the aims for which they are governed.

In fact, some practitioners can even claim that no one needs a theory to be effective, efficient, sustainable and competitive. They can say that “we should do what has to be done, do it well and get the results”. However, if it was that simple: “why organizations do not do it...?” Because, each context is different, having its own peculiarities, threats and opportunities, which need to be instantiated and analyzed appropriately to produce an effective response.

We can advocate that the system described by our theory is a dynamic scenario to build an understanding of their own actuality. For instance, the emerging theory is helpful to identify, progressively, "which are" the agile/lean capabilities [A] that should be combined coordinately upon governance capabilities [G] (in each stage of development), which can generate results as soon as possible, with the resources available at the time, in order to reduce the disturbing or limiting effects from external [E] and internal [M] factors, and therefore, increase the level of the business operations [B] and the value delivered [R]. In this manner, executives and teams can address their overall business strategy, using Agile Governance Theory as an adaptive and reflexive reference to find their own way toward maximizing the delivery of business value.

Another relevant fact is that despite how obvious it may seem, we found no theoretical approach to describe or allow the analysis of agile governance phenomena. Actually, the approaches found in the form of models, frameworks and practices only discuss the agile specific approach, such as agile software development or agile manufacturing. Likewise, they were punctual, not allowing us to build a reflexive systemic analysis of cause and effect and about interactions of their elements, among other relevant aspects.

Before this work, even the meaning of agile governance was misunderstood, (1) apply governance approaches upon agile/lean practices, or (2) put into use agile/lean philosophy (principles, values, etc.) on governance activities: which one would be considered agile governance? (see Section 3.7.10). For instance, after the emerging of our theory, the characterization of the 1st and 2nd Laws of interaction make this meaning very clear, as well as the identification of the related theoretical scenarios, currently, make this distinction easy and unmistakable.

In that point the simplicity and obviousness of our approach is a positive point, and no longer a disadvantage, but it becomes a great advantage, allowing easy assimilation of the theory and its application in any organization, regardless of how naive it may seem. Indeed, there is almost a poetic beauty in this simplicity.

Besides, we have provided a specific Section (4.6) in benefit of theory application, presenting a set of guidelines on how to put the emerging theory into practice, such as: depicting theory lifecycle, suggesting how to track theory inputs/outputs in the lifecycle, discussing the lifecycle as a timebox, describing how to use MAnGve to apply the theory (lifecycle coupling), and examining the time effect and theory evolution.

In consideration of **utility**, the Agile Governance Theory can be used by executives, teams and organizations to: (1) align the whole of organizational context capability to the governance needs of the organization, adopting an agile approach in order to make them more responsive to changes in the business environment; (2) identify any factor that can have harmful effects on organizational context and that could be treated or faced; (3) identify any gaps in competencies that could be eliminated, or competences that must be developed, encouraged or addressed through training or mentoring, to handle with those factors; (4) assist executives and teams to become aware of their actuality and address their overall business strategy, giving them an adaptive and reflexive reference to find their own way toward maximizing the delivery of business value.

Aiming to achieve the best utility of this theory, people should ***adapt*** (or instantiate) it to their own actuality in consideration of reflect the specific needs of every context. This may mean adapting the theory: (1) to reflect their unique culture, value and mission; (2) to align with key documents, for example the organizational policy and procedures; (3) to incorporate the

language or terminology used in their organization; even, (4) whether the organization has an existing governance framework, this can be aligned with the Agile Governance Theory.

All these efforts, lead us to hope that the emerging theory can be a useful and adaptable tool towards business agility, sustainability and organizational competitiveness; i.e., allowing that organizations deliver value faster, better, and cheaper to the business.

6.4 Contributions

Regarding the main product of this research, the Agile Governance Theory presented in this thesis is the first theory building study about agile governance phenomena, which combines Agile/lean philosophy and IT Governance approach.

Concerning to scientific approach this research also depicts a multi-method research, where we apply in combination a systematic literature review, observation and interaction on professional groups based on social networks and semi-structured interviews with emphasis on qualitative aspects. Further, we have framed the theory development and operationalization using Dubin's method of theory building, and we have tested it by means of a cross-sectional research explanatory survey with quantitative approach. Actualy, we can consider the research framework depicted in **Figure 2.1**, as a contribution for *theory building research*, once we could not find a research framework that mixes qualitative and quantitative approaches for theory building, neither combines the methods applied in this research. Likewise, it can be considered a collateral contribution: our re-reading from Dubin's method depicted in Section 2.5.4, expliciting its feedback cycle.

In addition, we did not find any other doctoral thesis that has adopted the Dubin's method of theory building and it had executed and analyzed the results of the eighth step of his method (testing). Usually, the found doctoral *theses* are limited to propose a research agenda for performing the eighth step of the Dubin's method, in a future study, out of the scope of their own thesis (Garcia, 2008; Lynham, 2000; Tuttle, 2003).

In this research, we have reached a better understanding of the agile governance phenomena, conceptualizing and characterizing them in a chaordic path, as well as proposing six meta-principles and nine meta-values in order to drive future researches and practices in this topic.

Moreover, we have developed and evolved a theory for analysis and description of the agile governance phenomena, comprising: six constructs, six laws of interaction, its boundary-determining conditions, and seven macro-states and five system states of the theory (organized into two detailed state machines); as well as we have operationalized theory identifying 11 propositions, 24 empirical indicators (which can be refined and adjusted according to the organizational context studied), and 16 hypotheses (to test theory in the empirical world), in addition to eight theoretical scenarios where the theory can take place, to cite just a few of the theory elements. Nevertheless, we went further and we wrote an entire Section (4.6) of the thesis describing a systematic and adaptive way of how to put theory in action, applying it by means of our previous work (MAnGve coupling) (Luna, 2009).

Further contributions of this thesis follow:

i. The advancing in the state of the art of agile governance, providing a mapping of findings organized in four major groups and 16 categories, which can be figured out by relevance and convergence (Section 3.7, APPENDIX I.5, APPENDIX I.7, APPENDIX I.8 and APPENDIX II).
ii. The diagnosis of agile governance as a nascent, wide and multidisciplinary domain, focused on organizational performance and competitiveness that needs to be more intensively studied and might have its boundaries better defined (Section 3.7.10).
iii. The positioning of agile governance as a socio-technical phenomena established in a chaordic range (Section 3.7.10).
iv. Some insights on how this research is contributing to help scholars and practitioners to understand the agile governance phenomena more clearly, and consequently admit achieving the necessary fluency in this area of knowledge, in order to conduct it to a new baseline, accelerating its development (Section 3.7.10).
v. A new and convergent definition for agile governance (Section 3.7.11).
vi. Six meta-principles for agile governance (Section 3.7.11).
vii. Nine meta-values for agile governance, organized in four statements (Section 3.7.11).
viii. The concept of a dynamic repository for the knowledge related to governance topic (GBOK) and some directions for research and practice (Section 3.7.11).
ix. The conceptual development of a theory about agile governance, adopting mixed methods, and framed by means of the Dubin's method of theory building research (Section 4.3).

x. The theory research operation by means of the Dubin's method for theory building research (Section 4.4).

xi. The design of an empirical study to test the theory's hypotheses and assess the theory's plausibility (Section 5.2).

xii. The development of Structural Equation Models for each theoretical scenario depicted from the theory to be used during the empirical study (Section 5.2.1.1).

xiii. A scientific approach that can help researchers and practitioners to advance methodology for combining diverse study types, as well as qualitative research, in pragmatic business agility interventions (Chapter 2). We believe that the scientific and methodological approach can, at least, inspire researchers and practitioners in future qualitative and quantitative researches.

xiv. A plausible theory to describe and analyze the agile governance phenomena, their constructs, mediators, moderators and disturbing factors; which must be scrutinized by further studies in order to reach a *trustworthy* theory (Chapter 4).

xv. A theory that can be instantiated by a lifecycle for implementation and improvement of sustainable business agility (Section 4.6.1).

xvi. A theory that can be coupled to MAnGve for practical application (Section 4.6.4).

Finally, despite many applications of agile governance that have been found by this research, the findings of our systematic review, point out the agile governance paradigm as a nascent area, lacking consensus about concepts, patterns perceptions and direction. We have observed these phenomena starting to take shape, with the first few published definitions, some categories emerging, the start of a language's construction, though still with many noises, distortions and ambiguities. Hence, we really hope that this work can be a wealthy contribution to give a unified view of ongoing agile governance practice, and that it can make a decisive contribution to the **next great event on agile governance phenomena**, related to the *alignment of language* to allow an adequate communication among the scholars and practitioners in an effective way, as well as drive them to action. This episode shall support the academy and industry to communicate and understand the phenomena more clearly, and consequently admit achieving the necessary *fluency* in this area of knowledge in order to conduct it to a new baseline, accelerating its development.

Eventually, we believe that not only software development industry, manufacturing industry, and IT industry, but also the whole business industry, will benefit with these results. Enhancing

the competitiveness of governments and companies through the improvement of their governance and management shall result in significant economic returns. We think the proposed approach can contribute to these goals. In a broader context, we infer that it might help any kind of organization to deliver value faster, better, and cheaper to the business.

6.4.1 Publications

In addition, we had the opportunity to share part of those findings with the academy and industry by means of the following publications on international Conferences and Journals:

Luna, A. J. H. de O., Kruchten, P., & Moura, H. P. de. (2015). Agile Governance Theory: conceptual development. In D. M. G. Sakata (Ed.), *12th International Conference on Management of Technology and Information Systems* (p. 23). São Paulo: FEA-USP.

Luna, A. J. H. de O., Kruchten, P., Pedrosa, M. L. G. E., Almeida Neto, H. R. de, & Moura, H. P. de. (2014). State of the Art of Agile Governance: A Systematic Review. *International Journal of Computer Science & Information Technology (IJCSIT)*, *6*(5), 121–141. doi:10.5121/ijcsit.2014.6510

Luna, A. J. H. de O., Kruchten, P., & Moura, H. P. de. (2014). Constructing a Theory of Agile Governance: a step towards Business Agility. In *CBSoft 2014 - WTDSoft 2014*. doi:10.13140/2.1.1705.1841

Luna, A. J. H. de O., de Farias Júnior, I., Kruchten, P., & Moura, H. P. de. (2014). MAnGve: a step towards deploying Agile Governance. In *Brazilian Symposium on Software Engineering (SBES) - Industry Track (CBSoft 2014)* (pp. 2008–2011). doi:10.13140/2.1.2163.9367

Luna, A. J. H. de O., Kruchten, P., & de Moura, H. P. (2013). GAME: Governance for Agile Management of Enterprises: A Management Model for Agile Governance. In *2013 IEEE 8th International Conference on Global Software Engineering Workshops* (pp. 88–90). Ieee. doi:10.1109/ICGSEW.2013.20

Luna, A. J. H. de O., Costa, C. P., Moura, H. P. de, Novaes, M. A., Nascimento, C. A. D. C. do, & DE MOURA, H. P. (2010). Agile Governance in Information and Communication Technologies: Shifting Paradigms. *JISTEM Journal of Information Systems and Technology Management*, *7*(2), 311–334. doi:10.4301/S1807-17752010000200004

6.4.2 Citations

Also, we have found evidence that this research, even before being completed, has started to impact its field of study, resulting in a number of citations received by our publications focusing on various aspects of their contributions, as follows:

Yamakami, T. (2015). A gap analysis of enterprise Gamification applications with social servicenics theory: challenges and implications. In *Service Systems and Service Management (ICSSSM), 2015 12th International Conference on* (pp. 1–5). doi:10.1109/ICSSSM.2015.7170189

Gregory, P., Barroca, L., Taylor, K., Salah, D., & Sharp, H. (2015). Agile challenges in practice: a thematic analysis. In *16th International Conference on Agile Software Development*, XP 2015.

Moran, A. (2015). Managing Agile: Strategy, Implementation, Organisation and People. *Springer International Publishing*.

De Almeida Neto, H. R., de Magalhães, E. M. C., Moura, H. P. de, Teixeira Filho, J. G. de A., Cappelli, C., & Martins, L. M. F. (2015). Evaluation of a Maturity Model for Agile Governance in ICT using Focus Group. In XI Brazilian Symposium on Information System (pp. 15–22). SBIS 2015 Proceedings - AIS Electronic Library.

Poligadu, A., & Moloo, R. K. (2014). An innovative measurement programme for agile governance. *International Journal of Agile Systems and Management*, 7(1), 26–60.

Almeida Neto, H. R. De, & Moura, H. P. De. (2014). MAnGve Maturity Model (M3): Proposing a Maturity Model to Support Agile Governance in Information and Communication Technology. In *X Brazilian Symposium on Information System*. SBIS 2014 Proceedings.

6.5 Limitations

Usually, the major limitations of a doctoral thesis resides on the **methodological approach adopted** to carry out the research. In this aspect, this thesis mixed methods combine qualitative and quantitative research approach elements, in order to emerge with a robust theory to analyze and describe the agile governance phenomena. The risk related to the adoption of two methodological paradigms has been reduced by the development of a research design, by means of the research framework depicted in **Figure 2.1**, which was successful to define the integration design between these two approaches. Furthermore, the research framework was followed in a disciplined manner, generating results and publications in each stage.

In regards to the methods adopted in this research, some scholars may question the **modest number of interviews** carried out with representative agents from the phenomena under study, or even because the **moderated amount of social professional network observed**, during data collection. However, we can advocate that we have interrupted the interviews and

network observations (theoretical sampling) when we noticed complete redundancy, or *theoretical saturation*, in the new data (Glaser and Strauss, 2009).

Other point that we must consider is about the survey sampling: our sampling composition has adopted a mix of **purposive sampling** types (Patton, 1990), when could be better whether we have adopted a **random sampling** (Section 5.2.2.2). However, that choice can be justified by the nature of the phenomena under study as an eight-year-old topic, and a young and nascent area, considering the publication of the first definition of agile governance by Qumer in 2007 [S54]. In that case we had some difficulty to apply random sampling in this peculiar context, where the representative agents of these phenomena were rare and difficult to identify, and so they needed to be chosen intentionally. In addition, despite all the effort and energy employed on the empirical study data collection, we have a **small survey sample size** (N=118), although representative enough (above the size required by the statistical method adopted) in order to develop statistical analysis. Regardless, we believe that due to the methodological diligence (rigor) followed by this research, the obtained results, are at least, representative sampling from the phenomenon under study.

Concerning to ***generalizability*** of the findings, we have some limitations related to the survey sample comprised in its major amount (87.3%) by "typical cases" (see discussion in Section 5.2.2.2). Therefore, with typical case sampling, we cannot use the sample to make generalizations to a population, but the sample could be illustrative of other similar samples (Patton, 1990). Further, because we have used some techniques from Grounded Theory we inherit some limitations of the method, i.e., we are often faced with criticism on literature regarding the generalizability of the findings when we employ this method (see Section 5.5).

We can also infer as a potential *bias* the **influence of some "explanatory variables"** that could have affected the adjustment of quality indices from the models derived from each theoretical scenario depicted from emerging theory, can be the reason, namely: (1) the subject's experience on agile governance phenomena; (2) the organizational context chosen to answer the questionnaire; (3) the self-evaluating positioning into Chaos & Order Scale; and, (4) the choice of the best suited theoretical scenario. In order to test that supposition, in future studies, using larger sample, we should analyze those subsamples (groups of cases) separately and compare results. Other alternative to reduce that potential bias could be develop distinct

questionnaires, adopting distinct group of empirical indicators (contextualized) for every combination of those "explanatory variables", in future studies.

Moreover, despite the data collection instrument (questionnaire)[75] we have evaluated, with more than 15 representative agents of the phenomena under study, by means of a Pilot Survey (see Section 5.2.1.3.1), we must refine the questions wording and develop some concepts more clearly. For instance, based on the EFA statistical analysis (Section 5.2.4.1), we had to remove some manifest variables from the models because their common factor did not adequately explain the variance of these items (e.g., x_2 and x_3, their communalities were ≤ 0.50).

Other point related with the SEM analysis, regarding the quality indices adjustment of the models is the size sample. Some indices behave erratically across estimation methods under conditions of small sample size. For instance, *Normed Fit Index* (NFI) is not a good indicator for evaluating model fit when the sample size is small (Section 5.2.5.2.1). In order to minimize this potential bias we have applied *Bootstrap procedure* with 2000 resampling.

Another kind of quite common limitation, for this type of study, is the absence of the external validation of the ongoing research. That issue was overcome by the publications achieved by this research in international Conferences and Journals (Section 6.4.1), including the citations received from other authors (Section 6.4.2).

In conclusion, none of those *limitations* or *potential bias* related on this Section threatens the scientific rigor, or significance and credibility of the results of this research, neither does the conclusions to which they led. These limitations can be faced as useful lessons learned that can direct future work on the assessment and refinement of the emerging theory.

6.6 Future work

The scientific method in its objectivity, rigor and "seek for truth", sometimes it may seem insane, when the answer to a question simply generates more questions. And these questions lead to more research, aiming to build an even more understandable scenario of the phenomena in study, in order to reach more contributions to industry and academy, and so

[75] Even by Dubin's criteria of *validity* and *instrument reliability*, and we added to them other two criteria, such as: clarity (wording) and relevance for each question.

humanity progresses. Hence, this study raises a number of interesting avenues for future research:

(1) The **systematic literature review** carried out about state of the art of agile governance should be *kept extended* in "time covering" and scope (i.e., updated and expanded), at least every two or three years. It would be a way to closely monitor the progress in this field of study.

(2) We believe that the classification of **agile governance emerging groups and categories** (carried out in Section 3.7.6, related to **Figure 3.7**), should be refined and deepened, which included analyzing the overlapping and intersecting among each category identified by this review and their relationships (as hereafter new emerging ones from new studies.

(3) In fact, the whole evidence related to **trends** and **shortcomings** (APPENDIX I) found by this review should be faced as backlog for future works in this paradigm.

(4) The **Governance Body of Knowledge (GBOK)** concept, proposed by this research in this domain should be refined, organized, connected and systematized, as well as it must have its scope and boundaries better defined in future works, in order to be a useful dynamic reference to help people and enterprises to achieve their business goals. Despite some of GBOK components being proprietary models, the agile governance community should use the same policies and mechanisms adopted by some open-source projects to maintain the consistency and cohesion of the elements that belong to the GBOK, such as the *modus operandi* employed by Linux community, for example.

(5) We are dealing with a nascent field of study where all set of knowledge should be organized, connected and systematized in some kind of conceptual framework or theory: we took the first step in this direction proposing the Agile Governance Theory. We also offer an alternative to connect that theory with the real world by means of its coupling with MAnGve. Thus, one promising research topic would be: **identify which are the frameworks, models and applications, which can be useful to organizations in order to help them to employ agile governance**.

(6) Particularly, in a future work we plan to **"gamify" the theory** by means of a Corporate Game (Luna et al., 2013) [S150], in order to "*motivate people to do extraordinary things"* (Burke, 2014) through Agile Governance Theory.

(7) Considering **theory refinement**, further empirical studies must be developed, such as: Case study, Focus group, Action research, Delphi session, broader Explanatory Survey, among others. The results from those studies should be crossed and analyzed in context (but without losing overall sight), as well as new scenarios should be identified and tested for the gradual arising of a widest, clearest and deepest view of the big picture described by the agile governance phenomena.

In the course of the Explanatory Survey described in Section 5.2.1.2, we have asked to the to the representative agents related to the phenomena under study how much they agreed with the the following statement "*the organization where I work has interest to adopt (or continue adopting) an agile approach to handle with governance issues*". Indeed, more than 58% of the respondents agreed that their organizations have interest to adopt (or continue adopting) agile governance. **Figure VI.15**, at APPENDIX VI.4, depicts the answer profile for that question. This clue appears to be a great opportunity for researchers and practitioners to pore over this topic, and develop a common agenda to help organizations with this perspective. Similarly, it also is a good chance to encourage organizations that have not yet realized the importance of this initiative.

At same time, the evidences found highlight the importance to stimulate both the quantity and, specially, the quality of studies on agile governance. Certainly, we can realize that there is a research backlog with topics that need to be tackled. Naturally, researchers and practitioners should work together to define a reciprocal research agenda for new research and practice on this domain, as well as to get closer to the wide spectrum of interest and application identified by this research.

Likewise, we invite enterprises to engage in research projects in the future, with the view to address research aims that are significant for the industry. Truly, action research is a contributive and convergent way of systematize cooperation between researchers and industry that would be immensely positive for a flourishing field such as agile governance. In retrospect, these findings represent a great opportunity for new research and practice on this domain. At the same time, they might represent an obstacle to be overcome for a most significant advance in the production of this field, for industry and academy.

Especially, we plan develop a *research program agenda for medium-term*, comprising some of those opportunities for future work, in order to advance in this field of knowledge.

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APPENDICES

APPENDIX I. SLR – Systematic Literature Review: Overview

APPENDIX I.1. SLR: Sistematic Literature Review Protocol

Research team

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Executive Summary

A systematic literature review, including mapping, (often referred to as a systematic review) is a means of identifying, evaluating and interpreting all available research relevant to a particular research question, or topic area, or phenomenon of interest. Systematic Mapping Studies (also known as Scoping Studies) are designed to provide a wide overview of a research area, to establish if research evidence exists on a topic and provide an indication of the quantity of the evidence. The results of a mapping study can identify areas suitable for conducting Systematic Literature Reviews and also areas where a primary study is more appropriate. Individual studies contributing to a systematic review are called primary studies; a systematic review is a form of secondary study (Kitchenham et al., 2007).

The main goal of systematic mapping studies is to provide an overview of a research area, and identify the quantity and type of research and results available within it. Often one wants to map the frequencies of publication over time to see trends. A secondary goal can be to identify the forums in which research in the area has been published (Petersen et al., 2007).

GP2 is the Project Research Group of the Informatics Center (CIn) of the Federal University of Pernambuco (UFPE), in Brazil. The main researches developed by the GP2 members are in the areas of: i) Project management frameworks and methodologies; ii) Organizational Project Management Maturity Model; iii) Project portfolio management; iv) IT management; v) Project risk management; vi) Software processes; and, vii) Agile Governance.

The cell of Agile Governance of GP2 composed by researchers and students of graduate Program of the Informatics Center (CIn) at Federal University of Pernambuco (UFPE), decided to conduct a research to extend the exploratory literature review done by (Luna, 2009), systematically, employing more scientific accuracy, expanding the search engines and complementing the time period until 2013. The original research project was done to catalog, classify, identify the principal authors and understand the relationship between the several approaches about the theme. The results of that project were intended to provide insights to propose an agile framework to implementing and improving governance in organizations, called MAnGve, result of (Luna, 2009) master degree thesis. A systematic review is a means of evaluating and interpreting all available research relating to a particular research domain. A systematic review protocol specifies the methods that will be used to undertake a specific systematic review.

After recent exploratory literature search, apparently, no systematic review about agile governance has been done yet. The existing reviews found are not about this topic or systematic; neither covers the wide application of this field of study. In other words, this implies that executives, professionals, researchers and practitioners no have a unified reference to get an overview about this domain. The authors expect that this research will be helpful to all of these groups, and that it will become clear which assertions on agile governance are sustained by scientific studies or industry practices.

As a result, this systematic was organized in order to prepare an overview of the topic area in which we will be working, providing evidences for consolidate and extend the initial results, as well as providing innovative knowledge for the development of two PhD thesis and five MSc dissertations in agile governance theme, and also establish a solid foundation for future research about the topic. The research group intends to actualize and expend the research to help the Agile Governance community.

Background

Systematic reviews, including mapping, are appropriate in areas with a wide range of research, but whose main questions remain unanswered (Petticrew and Roberts, 2006). For this study we defined exploratory questions to understand the construct Agile Governance.

Based on the related work we looked for a previous systematic review related with the topic in many domains as described below. In the **software industry**, according to Abrahamsson et al. (2002) there has been no systematic review about agile development methodologies found before 2002. After that, gradually, introductions about and overviews of agile software development are provided by a set of authors, such as (Abrahamsson et al., 2002), (Erickson et al., 2005) and (Dybå and Dingsøyr, 2008b). These set of publications portray the state of the art and practice about methods of agile software development, as well as learned lessons from application of such methods in software industry.

The systematic review on **agile software development** which has the recent highest annual citation rates, presenting the average over 120 citation by year as reported by Google Scholar (2013), was conducted by Dybå and Dingsøyr (2008) about empirical studies of agile software development up to and including 2005. As stated by them, the "*main implication for research is a need for more and better empirical studies of agile software development within a common research agenda*" for researchers and practitioners.

Dybå and Dingsøyr (2008) point out some evidences about the application of agility beyond Software Engineering area, such as: agile manufacturing, lean development, new product development, interactive planning, maturing architectural design ideas and strategic management. These insights were very useful for our systematic review because they gave us some directions and helped us classify more accurately the findings of this research.

Wang, Lane, Conboy and Pikkarainen (2009) [S17] conducted a workshop called "Agile Research – A 7-Year Retrospective". This workshop, which aimed to investigate *"where the agile research goes"*, was based on an open discussion around past papers presented at the *International Conference on Agile Processes and eXtreme Programming in Software Engineering* (XP), identifying current gaps and areas for future research. From the sample of 161 papers published on this conference, they classified ten of them as related to the emerging area of **business agility**, which was pointed out as one of *six emerging trends* that must be explored and studied and points the direction for where agile research goes. Although this approach cannot be considered a systematic review, it presented an **agile research topic map** that influenced the findings treatment of our systematic review.

In the **manufacturing industry**, Ramaa et al. (2009) address the dearth of research on performance measurement systems and performance metrics of *supply chain network* by reviewing the contemporary literature, developing a systematic literature review. Their study lists more than 60 references for further study. They present four definitions for Performance Measurement of Supply Chain (PMSC), as well as a brief discussion about the evolution of this issue.

In the **IT governance** area, Qumer (2007) [S54] presents a summary of an exploratory review and analysis to identity the related concepts, key aspects and importance of IT governance, but he does not deepens the discussion. Correspondingly, Qumer proposes a conceptual "*agile responsibility, accountability and business value governance model*", for large agile software development environments. Likewise, (Luna, 2009) conducted an exploratory review about the agile governance, using four electronic databases, found 75 references, and trying to identify, catalog, classify, the principal initiatives and authors, as well as understand the relationship between the several approaches about the theme, up to and including July 2009. The results of this work provided insights to propose a reference agile framework for implement and improve governance in organizations, called MAnGve. The

MAnGve framework is focused in the deployment process, as a catalyzer, it accelerates the governance implementation.

Recently, Wang, Conboy and Cawley (2012) [S165] carried out an experience report analysis to provide a better understanding of **lean software development** approaches and how they are applied in agile software development. The authors *"have examined 30 experience reports published in past agile software conferences in which experiences of applying lean approaches in agile software development were reported"*. The findings of the study enrich our understanding of how lean can be applied in agile software development. The authors have identified *six types of lean application* in these experience reports and categorized them in a more systemic way: i) non-purposeful combination of agile and lean; ii) agile within, lean out-reach; iii) lean facilitating agile adoption; iv) lean within agile; v) from agile to lean; and, vi) synchronizing agile and lean.

However, we did not find systematic reviews in other areas of knowledge related with the application of **agile** *capabilities* on **governance** *issues*. In other words, apparently, no systematic review about agile governance has been done yet. Therefore, there are no common understandings about the challenges that we must deal with, when examining the effectiveness of agile capabilities on governance issues, available for organizations and practitioners.

Overview

The fact that we did not find systematic review about Agile Governance reinforces the importance of this work. At the end of this work we intend to publish a paper explaining a unified and accurate view about as the domain of agile governance in the world. A systematic review process has three phases: planning the review, conducting the review and reporting the review. In this document, the first phase, planning the review is presented. The major activity in planning the review is designing a review protocol. This protocol includes many extra sources of studies.

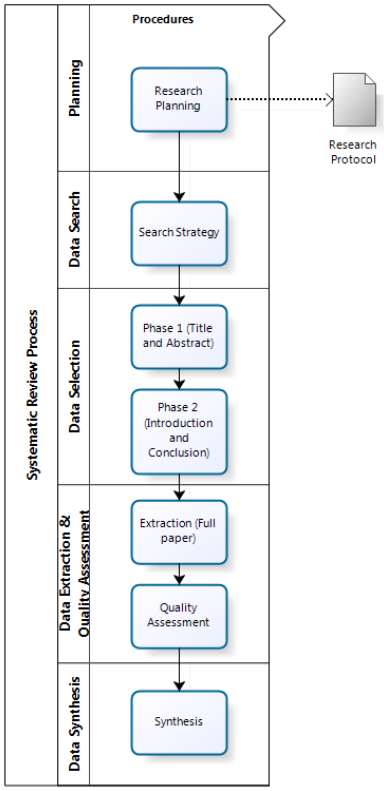

FIGURE I.1 - SYSTEMATIC REVIEW PROCESS.

The **Figure I.1** depicts the entire Systematic Review Process adopted in this research.

Protocol development

This research protocol for the systematic review was developed by complying the guidelines, policies and procedures of the Kitchenham's Guidelines for performing Systematic Literature Reviews in Software Engineering (Kitchenham et al., 2007) and complemented by the Dybå's approach (Dybå and Dingsøyr, 2008b), as well as by the consultation with specialists on the topic and methods. Succinctly, this protocol establishes: i) the research

questions; ii) search strategy; iii) inclusion, exclusion and quality criteria; iv) data extraction; and, v) methods of synthesis.

Research Questions

The main research question that motivates this study is:

RQ1: What is the state of the art of Agile Governance in the world?

In other words: How has behaved the domain of agile governance in the world? In which domains the agile governance phenomena manifest themselves? What are the works and initiatives in this domain? Who authors and which research groups has published about this theme? We are also interested to know how this domain is applied in the organizations and how this impacts people's lives and businesses.

In order to answer the previous main question, as well as to map evidences that will help team members to investigate specific aspects of the agile governance phenomena, which are relevant to their own graduate researches, the following **specific research questions** were defined, as follows:

RQ2: How the domain of agile governance has been evolved?
RQ3: Which are the concepts, practices, principles and values on this domain?
RQ4: Who are the authors and publication channels that have published about this theme?
RQ5: How agile governance is applied in the organizations and which are the perspectives?
RQ6: How agile governance has impacted people's lives and organizations' business?
RQ7: Which are the benefits and motivations for adopting agile governance?
RQ8: Which are the problems, challenges and critical success factors faced on the adoption of agile governance?
RQ9: Which are the support mechanisms applied for the implementation of agile governance?
RQ10: Which are the support mechanisms for assessing the capability, maturity or evolution stage of organizations regarding agile governance?
RQ11: Which are the mechanisms for auditing the processes of organizations regarding agile governance?
RQ12: Which are the indicators and metrics applied for monitoring the progress of agile governance?
RQ13: Which are the initiatives of agile governance implemented in multi-organizational environments?
RQ14: Which are the management models, frameworks or architectures used in the organizations under the context of agile governance?

Inclusion and Exclusion Criteria

In consonance with the research protocol, the studies should be suitable for inclusion in the review if they offer evidences that help to answer fully or partially at least one of the research questions. Due this work being a systematic review, whereby the authors are intended to identify the maximum of evidence to help them to set up a consistent view about the state of the art of agile governance, it will not defined a minimum quality threshold for exclusion of papers. In other words, the quality will be a criterion of classification and assessment of strength of evidences, but it was not an elimination criterion.

Studies of both professional and students should be included without distinction. Inclusion of studies will not limit to any particular type of approach, intervention or result measure. We should include studies that addressed in their goals, hypothesis and applications, or analyze, in their results, the application of agility on governance issues. Qualitative and quantitative studies published up to and including 2013 will included in the systematic review. We should include only studies written in English.

We should exclude studies if their focus is not: computer science, general theory of administration or general systems theory. In like manner, technical content that have not passed through a sieve of external review should be excluded, such as: books, technical reports, dissertations, etc. In a similar vein, studies that are not complete articles should be excluded, such as: extended abstract, keynotes, presentations, among others. Studies that expressing personal points of view or opinions should be excluded, as well as articles that are in the areas of this research, but they clearly are not related to the research questions.

Exclusion Criteria

The following studies will be excluded:

TABLE I.1- SLR: EXCLUSION CRITERIA.

Exclusion Code	Description
EC01	Studies **not published in English**.
EC02	Technical content, **without proven scientific relevance**, eg: Invited papers, **editorials**, tutorials, key-note speech, **white papers**, **thesis**, dissertations, **technical reports**, **books**.
EC03	Articles that **expressing personal points of view** or **opinions**. **IMPORTANT: This code should be ONLY used from the Selection Stage - Phase 2**.
EC04	Documents that are **not complete papers** or **studies,** e.g. **presentations** (PPTs), **web postings**, **web content**, **citations**, pamphlet, brochure, prospectus, **newsletter** or **extended abstract.**
EC05	Studies that clearly are not belonging to the great areas of: (1) **Computer Science**; (2) **General Theory of Administration – GTA;** or (3) **General Systems Theory - GST**.
EC06	**Articles published up to and including 31/12/2013.**
EC07	Articles that are in the areas of research, but **clearly not are related to the research questions**, and thus escape the focus of this research. **IMPORTANT: This code should be ONLY used from the Selection Stage - Phase 2.**

Inclusion Criteria

The following studies will be included:

TABLE I.2 – SLR: INCLUSION CRITERIA.

Inclusion Code	Description
IC01	Complete articles published in journals and conferences **about the context of this research**
IC02	Scientific studies that **address in its goals**, **hypothesis** or **applications** the research questions of this study.
IC03	Scientific studies that **analyze, in its results,** aspects related to the Agile Governance paradigm.

Search Strategy

Our search strategy combines scientific electronic databases and the Google web search engine to identify and retrieve the entire population of publications that meets the eligibility criteria specified in previous Sections. We will search in the following electronic sources:

- ACM Digital library
- Scirus
- IEEE Xplore Digital Library
- ISI Web of Science
- ScienceDirect – Elsevier
- Scopus
- SpringerLink
- Google Scholar
- Publish or Perish (POP)
- Google PDF Documents*

The Figure I.2 depicts the systematic review process and the quantity of papers identified and analyzed on each stage. The following sections report as the methodological approach was applied in each stage.

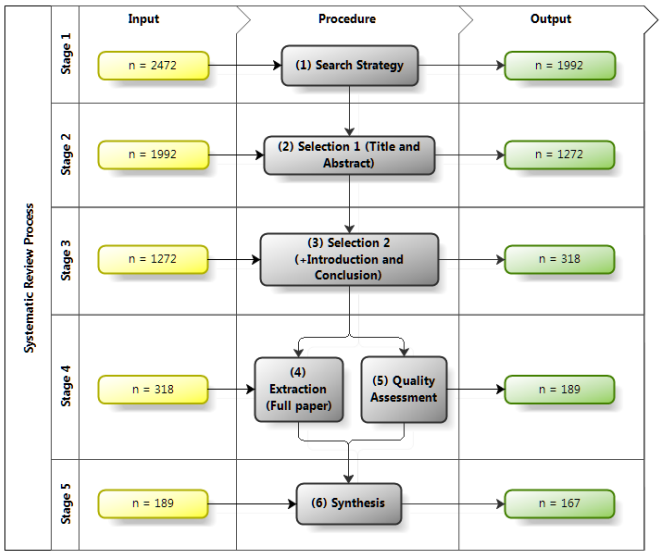

FIGURE I.2. - SYSTEMATIC REVIEW RESULTS.

Search string

At the **stage 1**, the titles, abstracts, and keywords in the aforementioned electronic databases (except Google PDF documents) should be searched applying the following search terms:

(1) "agile governance"

(2) "lean governance"

(3) agile OR agility OR lean

(4) governance OR govern OR government OR "public administration"

(5) business OR enterprise OR corporate

(6) "service management" OR "information technology" OR "information and communication technologies" OR IT OR ICT

In addition, these terms must be combined by applying the *boolean* operators, ''OR" and "AND", which implies that an article just has to include combinations of the terms to be retrieved, according the following *"search string"* (S):

S = (1) OR (2) OR ((3) AND ((4) OR (5) OR (6)))

Eventually, we have to adjust the search string for the syntax of each electronic database, in other cases the searches has to be carried out in complementary steps (due to the limitation of the search interface of each database), though maintaining the same logic. Meanwhile, for the Google PDF Documents, due to the large amount of results, the *search string* was simplified to:

S = (1) OR (2) filetype:PDF daterange:..2013-12-31*

We should exclude from the search: article summaries, presentations, interviews, prefaces, correspondence, posts, news, discussions, reader's letters, panels and summaries of tutorials, comments, and poster sessions. Based on those ten electronic sources, the search strategy culminated in a total of 2472 ''results" (or "hits") that included 1992 unduplicated citations.

Teamwork, tool and distributed research

At the same time, along this review was developed a software application (a tool) to support the research procedures. This software development was iterative and incremental, as well as the research database was hosted on a cloud, allowing the research was carried out in a geographically distributed way, by the internet. Therefore, for each stage, new interfaces and features were developed and made available for the researchers.

During the stages 1 to 4 the team was arranged into groups composed by two researchers (or "pair"). At the stage 1 and 2, the researchers were organized into four pairs. Similarly, at the stages 3 and 4, the researchers were organized into three pairs. Meanwhile, at the stage 5, the work was developed individually, i.e., at this stage the

set of research questions (RQs) were distributed among the researchers. Then they sought to answer the set of RQs based on the evidences found, and the result passed by a revision and cross-checking among them.

Table I.3. SLR: KAPPA COEFFICIENT AND PERCENTAGE OF AGREEMENTS.

Stages	Kappa Pair 1	Kappa Pair 2	Kappa Pair 3	Kappa Pair 4	Kappa Stage	% Agreements
2	0.88	0.57	0.28	0.23	0.61	80.6%
3	0.74	0.70	0.39	-	0.65	86.6%
4	0.78	0.88	0.72	-	0.80	91.1%

During the stages 1 to 4 the researchers from each pair were randomized, to reduce bias and to allow a broad exchange of experience between them. The set of studies analyzed by each pair (called "lot") was randomly distributed among the pairs, at each stage, by the tool developed. Nonetheless, this procedure ensured that two researchers of each pair analyzed the same "lot" at the same stage.

Whether before the deadline of the stage, there was disagreement between the decision of them, the tool pointed out and they had to reach a consensus, otherwise, the paper was included for next stage. When was not possible to make a face-to-face meeting to discuss the disagreements the pair conducted the disagreements discussion through voice over IP tools (such as Skype or Gtalk) and the pair's leader set the final decision in the research database by the tool, on the internet.

Citation management, retrieval, and inclusion decisions

At the **stage 1**, the electronic databases were randomly distributed among the pairs. Significant citations from this stage (n = 2472) were entered into, complemented, organized and catalogued with the assist of *Mendeley*[76]. The results (or "hits") were then imported by the developed tool for a *research database* which was hosted on the cloud, where were registered the source of each citation. The duplicity were removed by "title", resulting in a set of (n = 1992) "hits" at the end of this stage.

At the **stage 2**, both researchers of the same pair analyzed the title and abstract from the same "lot" of papers, that resulted from stage 1, to define their importance to this systematic review. At each stage, the researchers' retrieval decision, retrieval status, and eligibility decision were recorded on the research database.

At this stage, the researchers excluded papers that were surely not about agile governance. As an illustration, because our search strategy contained the terms ''public administration" and "govern", we got some ''hits" about discussion upon "environmental impacts in urban areas" (on health care context) or articles related to "jurisdictional democratic integrity" (on public law context). In both cases, the title and abstract does not mentioned governance issues neither agile (nor lean) approach. We excluded articles with titles and abstract that indicated expressly that they were off the scope of this review. Notwithstanding, titles do not always give evident indication of what a paper is about. The research team found that abstracts were of variant quality, as well some abstracts were missing, poor, and/or deceptive, and many gave little clue of what was in the entire article. In those cases, the papers were included for analysis in the next stage. Hence, 720 papers were excluded at this stage.

For the 1992 papers analyzed, the number of detected agreements was 1606 (80.6%). The Kappa coefficients of agreement (Cohen, 1960) observed by each pair were computed, and they are depicted in **Table I.3.** The Kappa coefficient for stage 2 assessments was 0.61, which is typified as "substantial", in agreement with Landis and Koch (1977). Actually, this was result of the existence of two pairs more experienced and other two less experienced in systematic reviews. Even though the pairs 3 and 4 presented a Kappa coefficient lower than the pairs 1 and 2, those values are characterized as "fair" by the same criteria.

At **stage 3**, the researchers analyzed (in addition to title, abstract and keywords) the *introduction* and *conclusion* for each paper from stage 2, to ascertain their pertinence to the systematic review. Once more, studies were removed when they did not mention any consideration about the application of agile capabilities on governance issues. Whenever there was unsure whether a study complied to the screening criteria, based on the title, abstract, introduction and conclusion, the paper was included the next stage.

For the 1272 papers analyzed, the number of detected agreements was 1101 (86.6%). The Kappa coefficients of agreement are depicted in **Table I.3**. The Kappa coefficient for stage 3 appraisal was 0.65, which is featured as "substantial", in keep with Landis and Koch (1977). Although the evolution of the Kappa coefficient for this stage seem small, between this and the previous stage, we have a substantial evolution of the Kappa coefficient from the less experienced pair, as well as it is already possible to interpret this progress as an indicator of the team's

76*Mendeley* is a desktop and web software for managing and sharing research papers, discovering research data and collaborating online (Mendeley, 2013).

learning, proportionate by the exchange of experiences between the team members, as a consequence of the random shift of the researchers for each pair, in each stage.

All disagreements were treated by discussion that comprised the two researchers from pair, according the procedure described previously. As a consequence of this debate, another 954 articles were excluded at this stage, which left 318 papers for the itemized quality assessment.

TABLE I.4. SLR: QUALITY CRITERIA.

Rigor Assessment Questions
1. Is there a clear definition of the study objectives?
2. Is there a clear definition of the justifications of the study?
3. Is there a theoretical background about the topics of the study?
4. Is there a clear definition of the research question (RQ) and/or the hypothesis of the study?
5. Is there an adequate description of the context in which the research was carried out?
6. Are used and described appropriate data collection methods?
7. Is there an adequate description of the sample used and the methods for identifying and recruiting the sample?
8. Is there an adequate description of the methods used to analyze data and appropriate methods for ensuring the data analysis were grounded in the data?
Credibility Assessment Questions
9. Is provided by the study clearly answer or justification about RQ / hypothesis?
10. Is provided by the study clearly stated findings with credible results?
Relevance Assessment Questions
11. Is provided by the study a definition of Agile Governance (AG) or a definition some concept closely related with AG?
12. Is provided by the study justified conclusions?
13. Is provided by the study discussion about validity threats?

Inaccessible List

During the **stage 3** there were 47 papers from the 1272 that the researchers had no full access to PDF file or HTML version to read *introduction* and *conclusion* sections and making an eligibility decision, according the research protocol. This list was called research's "*inaccessible list*". In this case, each pair sent an email to the authors and/or to the publisher explaining the research aims and asking for grant access to the paper. As some authors and publishers have made available their papers for assessment, at the end of this stage this list was reduced to 26 papers. In other words, the papers that are in this list, *apparently,* have denotation of relevance for this research, but could not be assessed to confirm this supposition.

Full Analysis

The data extraction (DE) and quality assessment (QA) procedures occurred simultaneously. Nonetheless, as a matter of clarity, these two procedures of the **stage 4** will be explained separately. From the 318 papers selected at the previous stage, 26 of them belonged to "*inaccessible list*", and could not go through these procedures, as well as will be not accounted in the citations after this stage.

Each of the 292 remaining studies was read entirely at least twice by each research of the same pair. After the second reading of the paper, each researcher (from the same pair) set his/her decision about exclusion or inclusion of each paper in the research tool. When the both researchers of the same pair finished the **individual analysis** the research tool pointed out if there were disagreements between them. All disagreements were treated by discussion that involved the two researchers from pair, the pair had to reach a consensus, otherwise, the quality assessment was carried out, the paper was extracted, and included for next stage.

For the 292 papers analyzed, the number of observed agreements was 279 (91.1%). The Kappa coefficients of agreement are depicted in **Table I.3**. The Kappa coefficient for stage 4 was 0.80, which is typified as "substantial", as pointed out by Landis and Koch (1977). Truly, under the pairs' point of view, at this stage we had two "substantial" Kappa coefficients and other one "almost perfect", according the same criteria. This result was further evidence of the evolution of the team's learning in this process. As a result of this analysis, another 103

articles were excluded at this stage, which left 189 articles for quality assessment, data extraction, and the subsequent synthesis procedures.

Quality Assessment

Each of the 189 remaining studies was assessed individually by each researcher of the same pair, in consonance with 13 criteria. The quality assessment criteria adopted for these studies is briefly depicted in **Table I.4.** These criteria were result from the analysis of methodological reference for appraising the quality of qualitative research (Merriam, 2009), as well as by the principles and good practices established for driving empirical research in software engineering (Dybå and Dingsøyr, 2008b; Dybå et al., 2007; Kitchenham et al., 2010, 2007).

The 13 criteria comprised three major issues referring to quality that have to be contemplated when assessing the studies identified in the review (see **APPENDIX I.3**.): (i) **Rigor:** Has a meticulous and suitable approach been used to key research methods in the study?; (ii) **Credibility:** Are the findings well-described and meaningful?; (iii) **Relevance:** How useful are the findings to the business industry and the research community.

As shown in the APPENDIX I.6, each criterion was graded on a scale composed by the following values: (2) when the criterion was *plentiful* or *explicitly* met; (1) when the criterion was *partial* or *implicit* met; (0) when the criterion was *absent* or *not applicable*. Hence, the maximum score that could be attributed to a paper was 26 points.

As previously mentioned, in this review, the quality was used just as a classification criterion. Each paper was assessed on the 13 criteria, as following: **eight** criteria were addressed to the *rigor* of the *research methods* applied in the study; **two** criteria were associated with the *credibility* of the study methods for assuring that the findings are credible and *meaningful*; and, finally, other **three** criteria were regard to the appraisal of the *relevance* of the study for industry and the research community, as well as to the *aims* of this systematic review.

After the **quality individual assessment** step, when there were disagreements between the values attributed by the researchers on each pair about the same study, the tool pointed this out, and the pair had to reach a consensus, otherwise, a third researcher from the another pair (usually the more experienced) was invited to discuss the disagreements. Before the end of the stage all disagreements were solved by discussion.

Data extraction

Next, we decompose the research questions and identify the *constructs* for each one. A sample of the constructs derived from research questions is available in Table I.5. Along a third reading, data was extracted from every of the 189 studies remaining in this review conforming to the predetermined extraction form (see APPENDIX I.4). During the extraction we carried out a coding procedure for each quote, pointing out the research questions that it helping to answer. Whenever possible, the team coded also the specific construct related.

TABLE I.5. SLR: Sample of constructs.

RQ1 ▪ Phenomena definition (meaning) ▪ Phenomena characterization ▪ State of theory and research ▪ Related fields: groups ▪ Context where take place: categories ▪ Overall trends
RQ2 ▪ Genesis ▪ Evolution ▪ Perspectives

Howbeit, when the researchers performed the extraction procedure they realized that extracting data was hampered by the manner some of the studies were described. By virtue of this, we too found that they diverged too much in what they actually extracted from the papers, for irrespective extraction to be significant. Hence, to align these procedures, the team (all researchers from all pairs) performed a data extraction pilot together (by voice over IP tool), applying the data extraction procedure for three papers (one from each pair), in order to gauge the perception and to establish patterns of extraction to all of them.

After the pilot, we resumed working in pairs. Both the researchers from each pair extracted full data, from all studies, and then they discussed the data extracted during consensus meetings. We copied verbatim into the tool

developed to support this research: the aims, research methods descriptions, settings, findings, and conclusions, as related by the authors of the studies. Those evidences were gathered for posterior qualitative analysis of textual data.

At the end of the stage 4, from the 189 articles, 1949 quotes were generated that helped answer fully or partially at least one of the research questions.

Synthesis of findings

Thereafter, during the **stage 5**, we use meta-ethnographic and qualitative meta-analysis methods, conforming to Noblit and Hare (1988), to synthesize the data extracted from the studies. Initially the quotes were organized by research question and the coding of the constructs was complemented whenever it needed. We also carried out an open coding procedure to identify supplementary aspects of the relationship of the construct and the emerging categories. At same time, it was a manner of identifying relevant words, or classes of words, in the data and then tagging them accordingly.

The second step of the synthesis was to ascertain the main concepts and categories from each study, adopting the original author's terms. The process was carried out by organizing the key concepts in tabular form to permit comparison crosswise studies and the mutual interpretation of findings into higher-order meanings, following similar approach of **constant comparison** applied in qualitative data analysis (Corbin and Strauss, 2008). In consonance with Birks and Mills (2010) we observe that the "*categories were theoretically saturated when new data analysis, emerged codes that only fitted in existing categories, and these categories were sufficiently explained in terms of their properties and dimensions"*, such as: *approach* and *focus*. When the researchers identified divergences in findings, they investigated whether these could be elucidated by the distinctions in methods or nature of the study setting (Britten et al., 2002).

During this stage, for each construct identified we applied the procedure proposed by Noblit and Hare (1988), following their seven-step process for carrying out a meta-ethnography, synthetized as follows: (1) Getting started; (2) Determining what is appropriate to the initial interest; (3) Reading the studies; (4) Analyzing how the studies are correlated; (5) Translating the studies into one another; (6) Synthesizing translations; and, finally, (7) Expressing the synthesis.

Consequently, this proceeding of reciprocal translation, reputational analysis and synthesis of studies, accomplished the following aims with regard to answering our encompassing research questions in the dimensions identified by each construct: i) it found out a set of higher-order insights, or themes, which persisted across studies; ii) it documented the evidences of the agile capabilities on governance issues, organized by category; iii) it emphasized gaps in the findings about the agile governance **initiatives**[77].

At this stage, two articles were considered duplicate and other 20 articles that had no evidences for help to answer fully or partially at least one of the research questions were excluded, leaving 167 studies as final findings from this systematic review.

Strength of evidence

There are several options to develop an assessment concerning to the strength of evidences in (Atkins et al., 2004). In keeping with Kitchenham et al. (2007), some of them propose that the strength of evidence can be established on a hierarchy where concreteness from randomized experiments and systematic reviews at the apex of this hierarchy and evidence from expert opinion and observational studies at the base of this hierarchy. Notwithstanding, setting up this kind of experiments sometimes demands a high time consumer or are not feasible in specific contexts. In these cases the application of observational studies can be a good alternative to produce better evidence.

Using an approach similar to Dybå and Dingsøyr (2008), we adopted the GRADE working group definitions to assess the entire strength of our review's evidences (Atkins et al., 2004). As stated in GRADE, the strength of evidence can be defined through the consolidation of four keystones, such as: (1) to study **design**, (2) study **quality**, (3) **consistency**, and (4) **directness**. These key elements are assessed in four level of grading: (a) **High**: Further research is quite improbable to change the reliability in the estimation of effect; (b) **Moderate**: Additional research is probable to have an relevant impact on the confidence in the estimation of effect and might modify the estimation; (c) **Low**: Further research is quite probable to have an relevant impact on the reliability in the estimation of effect and is probable to modify the estimation; and, (d) **Very low**: Any estimation of effect is very

77 "The power or ability to begin or to follow through energetically with a plan or task; enterprise and determination." (AHD, 2014).

unreliable. The GRADE system categorizes evidences establish on study design, assigning a high grade for randomized experiments and low grade for observational studies. Nevertheless, by the evaluation of the other key elements mentioned, the initiatory overall assess could be revised and amended, according the identification of inconsistences or high-quality observational inquiries, for instance.

APPENDIX I.2. SLR: Studies Included

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APPENDIX I.3. SLR: Quality Assessment Form

QA	Question	Score
	Rigor Assessment Questions	
1	**Is there a clear definition of the study objectives?** *Consider:* ***Plentiful or explicit (2):*** *The study objectives are clearly defined.* ***Partial or implicit (1):*** *The study objectives are not clearly defined, but are implicit in the text.* ***Absent or Not Applicable (0):*** *The study objectives are not defined.*	☐ Full ☐ Partial ☐ Absent
2	**Is there a clear definition of the justifications of the study?**	☐ Full ☐ Partial ☐

QA	Question	Score
	Consider: ***Plentiful or explicit (2):*** *The study objectives are clearly defined.* ***Partial or implicit (1):*** *The study objectives are not clearly defined, but are implicit in the text.* ***Absent or Not Applicable (0):*** *The study objectives are not defined*.	Absent
3	**Is there a theoretical background about the topics of the study?** *Consider:* ***Plentiful or explicit (2):*** *The study has a consistent theoretical background.* ***Partial or implicit (1):*** *The study has a fragile theoretical background.* ***Absent or Not Applicable (0):*** *The study has no theoretical background*	☐ Full ☐ Partial ☐ Absent
4	**Is there a theoretical background about the topics of the study?** *Consider:* ***Plentiful or explicit (2):*** *The RQ/ hypotheses of the study are clearly defined.* ***Partial or implicit (1):*** *The RQ/ hypotheses of the study are not clearly defined, but are implicit in the text* ***Absent or Not Applicable (0):*** *The RQ/ hypotheses of the study are not defined.*	☐ Full ☐ Partial ☐ Absent
5	**Is there an adequate description of the context in which the research was carried out?** *Consider:* ***Plentiful or explicit (2):*** *The type of study, as well as the research method, are clearly defined.* ***Partial or implicit (1):*** *The type of study is not clearly defined, but is implicit in the text* ***Absent or Not Applicable (0):*** *Unable to identify the type of study or the research method*.	☐ Full ☐ Partial ☐ Absent
6	**Are used and described appropriate data collection methods?** *Consider:* ***Plentiful or explicit (2):*** *The study clearly defines the method of data collection.* ***Partial or implicit (1):*** *The type of study, as well as the research method are not clearly defined, but are implicit in the text* ***Absent or Not Applicable (0):*** *The study no has or it does not mention the method of data collection*.	☐ Full ☐ Partial ☐ Absent
7	**Is there an adequate description of the sample used and the methods for identifying and recruiting the sample?** *Consider:* ***Plentiful or explicit (2):*** *The study clearly defines the subjects / research cases.* ***Partial or implicit (1):*** *The study defines superficially the subjects / research cases* ***Absent or Not Applicable (0):*** *The study does not define he subjects / researched cases*.	☐ Full ☐ Partial ☐ Absent
8	**Is there an adequate description of the methods used to analyze data and appropriate methods for ensuring the data analysis were grounded in the data?** *Consider:* ***Plentiful or explicit (2):*** *The study clearly defines how the data were analyzed.* ***Partial or implicit (1):*** *The data analysis method is not clearly defined, but is implicit in the text* ***Absent or Not Applicable (0):*** *The study does not mention the data analysis method*.	☐ Full ☐ Partial ☐ Absent
	Credibility Assessment Questions	
9	**Is provided by the study clearly answer or justification about RQ / hypothesis?** *Consider:* ***Plentiful or explicit (2):*** *All the RQ/ hypotheses of the study are answered successfully, or justified.* ***Partial or implicit (1):*** *Some of the RQ/hypotheses of the study are answered / justified* ***Absent or Not Applicable (0):*** *The RQ/ hypotheses are not answered and there are no excuses for this fact*.	☐ Full ☐ Partial ☐ Absent
10	**Is provided by the study clearly stated findings with credible results?** *Consider:* ***Plentiful or explicit (2):*** *The study results are presented clearly.* ***Partial or implicit (1):*** *The study results are presented without clarity or with ambiguity* ***Absent or Not Applicable (0):*** *The study results are not well presented, or minimally comprehensible*.	☐ Full ☐ Partial ☐ Absent
	Relevance Assessment Questions	
11	**Is provided by the study a definition of Agile Governance (AG) or a definition some concept closely related with AG?** *Consider:* ***Plentiful or explicit (2):*** *The study clearly and explicitly defines the concept of Agile Governance.* ***Partial or implicit (1):*** *The study does not define the concept of Agile Governance, but it defines any concept closely related with AG.* ***Absent or Not Applicable (0):*** *The study does not define the concept of Agile Governance, neither*	☐ Full ☐ Partial ☐ Absent

QA	Question	Score
	any concept closely related with AG.	
12	**Is provided by the study justified conclusions?** *Consider:* ***Plentiful or explicit (2):*** *Are presented sufficient data to support the conclusions.* ***Partial or implicit (1):*** *The data to support the conclusions are reasonable enough.* ***Absent or Not Applicable (0):*** *Are not presented sufficient data to support conclusions*.	☐ Full ☐ Partial ☐ Absent
13	**Is provided by the study discussion about validity threats?** *Consider:* ***Plentiful or explicit (2):*** *There is a specific Section where the threats to the validity of the study are discussed.* ***Partial or implicit (1):*** *The validity threats are discussed during the study.* ***Absent or Not Applicable (0):*** *The authors do not discuss the threats to the validity of the study*.	☐ Full ☐ Partial ☐ Absent

APPENDIX I.4. SLR: Data Extraction Form

ID	Field	Description
	Study (publication) Findings	
1.	Publication identifier	Unique ID for the Publication
2.	Date of data extraction	It is self-explanatory.
3.	Date of publication	It is self-explanatory.
4.	Bibliographic Reference	Author, Year, Title, Source, Publisher, URL
5.	Abstract	It is self-explanatory.
6.	Type of article	Reference Type: Journal Article, Conference Proceedings, Magazine article, Thesis, Book, Book Section, etc.
7.	Study Type	Each article was classified about the nature of the study, trying answering the follow question: "*Was the study reported empirical research or whether it was merely a 'lessons learned' report based on expert opinion?*". According this question the studies were classified as: (1) **Empirical**: when the study in question presented a coherent description about the methods applied with minimal scientific rigor; (2) **Expert opinion**: when the study in question presented "lessons learned" report, minimally grounded, based on expert opinion, without presenting the minimal scientific rigor to be classified as empirical; (3) **Application**: when the study in question presented the application of a specific technique, model, framework or practice, without presenting the minimal scientific rigor to be classified as empirical; or, (4) **Propositional**: when the study in question presented a new proposal on the studied field, without presenting the minimal scientific rigor to be classified as empirical. In fact, because this is a systematic mapping, no non-empirical research paper was excluded from this work.
8.	Study Design	Methodology applied by the authors for the study: Exploratory Analysis, Case Study, Exploratory Literature Review, Systematic Literature Review, Survey, Experience Report, Workshop, Grounded Theory, or other emerging methodologies cited by the authors.
9.	Sample Description	Verbatim from the study
10.	Setting of Study	Industry, in-house/supplier, products, technologies, patterns and processes used
11.	Country	The country of the first author.
12.	Engines	The set of electronic databases where were found the article in question.
13.	Category	Provides a classification suggested for the publication, based on the categories of original research. New categories can be created, if the analyzed publication does not fit into any of the existing categories.
14.	Category Explicit	Each article was classified about the clarity of category of the study: Yes: when the authors were explicit about the category; No: when the authors were not explicit about the category
15.	Quality Score	A score from zero to twenty six, obtained systematically from the sum of the score from 13 Quality Assessment criteria. As higher the score, higher is the quality attributed to the publication in question.
16.	Pages	Number of pages from paper.
17.	Research Nature	Each article was classified about the nature of the research: Industry: when the research was motivated or applied in any industry. Academy: when the research was motivated or applied on academic field.
18.	General Synthesis	A general synthesis from the study in question, with less than 500 words.
19.	Main contribution	A brief description of the main contribution from the study in question, with of less than 100 characters.
20.	Synthesis Convergence	Likewise, each article was classified about the convergence of the study with the aims of this research, using the Likert Scale (European Commission, 2003b), and trying answering the follow question:

<table>
<tr><th>ID</th><th>Field</th><th>Description</th></tr>
<tr><td></td><td></td><td>“How much convergent is the study reported with the aims of this research?”. According this question the studies were classified as: (4) – Strongly agreement: Strong convergence identified; (3) – Agreement: Convergence identified; (2) – Neither agree nor disagree: Neutral; (1) – Disagreement: Weak convergence identified; (0) – Strongly disagreement: Very weak convergence identified.</td></tr>
<tr><td>21.</td><td>RQs Evidences</td><td>For each study was developed a brief description from the evidences found, organized by construct, for each research question, with less than 500 words.</td></tr>
<tr><td></td><td>Study Approach Findings</td><td></td></tr>
<tr><td>22.</td><td>Study Synthesis</td><td>A synthesis from the study in question, with less than 500 words.</td></tr>
<tr><td>23.</td><td>Number of Studies developed</td><td>The total number of studies cited in the publication. Some of these publications presented more than one study.</td></tr>
<tr><td>24.</td><td>Study year</td><td>Year of conclusion of the study development.</td></tr>
<tr><td>25.</td><td>Number of organizations involved</td><td>The total number of organizations cited in the study.</td></tr>
<tr><td>26.</td><td>Size of Organization</td><td>Each study was classified about the size of the major organization participant of the study, using as reference the table from the EU recommendation 2003/361 (European Commission, 2003b):
<table>
<tr><th>Size of Organization</th><th>Employees</th><th>AND</th><th>Billing (Million €)</th><th>OR</th><th>Total Assets (Million €)</th></tr>
<tr><td>Micro</td><td><10</td><td>and</td><td>≤ 2</td><td>or</td><td>≤ 2</td></tr>
<tr><td>Small</td><td><50</td><td>and</td><td>≤ 10</td><td>or</td><td>≤ 10</td></tr>
<tr><td>Medium</td><td><250</td><td>and</td><td>≤ 50</td><td>or</td><td>≤ 43</td></tr>
<tr><td>Large</td><td>>250</td><td>and</td><td>> 50</td><td>or</td><td>> 43</td></tr>
</table></td></tr>
<tr><td>27.</td><td>Geography</td><td>Some studies can be applied in several countries. In this case, they must be classified as MULTINATIONAL. On the others situations, the team must classify the study by the Country name where the study happened. Examples: USA, Australia, China, Brazil, etc.</td></tr>
<tr><td>28.</td><td>Number of Employees involved</td><td>The total number of employees cited in the study.</td></tr>
<tr><td>29.</td><td>Target Population</td><td>Number of people who the study planned generate impact (involve).</td></tr>
<tr><td>30.</td><td>Sample Population</td><td>Number of people who the study really generated impact (involve).</td></tr>
<tr><td>31.</td><td>Mention Bias</td><td>Each study was classified trying answering the follow question: “Does the publication mention the possibility of selection, publication, or experimenter bias?”. According this question the studies were classified as: Yes or No.</td></tr>
<tr><td>32.</td><td>Mention Internal Validity</td><td>Each study was classified trying answering the follow question: “Does the publication mention possible threats to internal validity?”. According this question the studies were classified as: Yes or No.</td></tr>
<tr><td>33.</td><td>Mention External Validity</td><td>Each study was classified trying answering the follow question: “Does the publication mention possible threats to external validity?”. According this question the studies were classified as: Yes or No.</td></tr>
<tr><td></td><td>Quotes Findings</td><td></td></tr>
<tr><td>34.</td><td>Quote Text</td><td>An excerpt (piece) of the text of an paper, which was verbatim from the study, and that answers fully or partially one or several RQs with the following essential characteristics: i) It cannot be less than one sentence (phrase); ii) It must not be greater than a paragraph.</td></tr>
<tr><td>35.</td><td>Page and Paragraph</td><td>Number of page, separated by semicolon from the number of paragraph where this quote on the paper. Example: 1;2 (means page 1, paragraph 2).</td></tr>
<tr><td>36.</td><td>Quote Synthesis</td><td>A synthesis from the quote in question, with less than 500 words.</td></tr>
<tr><td>37.</td><td>RQs</td><td>The codes of research questions that this quote helps to answer fully or partially, separated by semicolon. Example: RQ2;RQ3; (means this quote helps to answer RQ2 and RQ3)</td></tr>
<tr><td>38.</td><td>Codes related</td><td>Provides a set of secondary codes that emerge from the quote, separated by semicolon.</td></tr>
<tr><td>39.</td><td>Quote Category</td><td>Provides a classification suggested by the quote, based on the constructs investigated for each RQ.</td></tr>
</table>

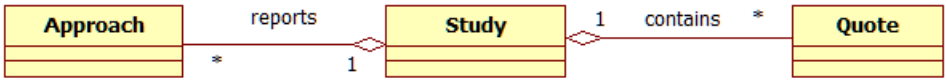

FIGURE D.1 DATA MODEL

APPENDIX I.5. SLR: Overview of the Studies

Study	ID	Group	Category	Research Nature	Methodology	Study approach	Study Type	Reference Type	Country	Year	Quadrant
S1	ACM-0025	G1	Software Development Governance	Industry	Experience Report	1	Expert opinion	Conference	USA	2008	Q4
S2	ACM-0034	G1	Governance for Agile Software Development	Academy	Exploratory Analysis	1	Propositional	Conference	SLOVENIA	2008	Q4
S3	ACM-0035	G1	Governance for Agile Software Development	Academy	Exploratory Analysis	1	Propositional	Journal	SLOVENIA	2008	Q4
S4	ACM-0040	G2	e-Government	Academy	Case Study	1	Propositional	Conference	THE NETHERLANDS	2010	Q4
S5	ACM-0056	G1	Governance for Agile Software Development	Academy	Exploratory Analysis	1	Expert opinion	Conference	CANADA	2009	Q3
S6	ACM-0057	G1	Governance for Agile Software Development	Industry	Mixed: Grounded Theory, Non-evidenced Experiment	2	Empirical	Conference	INDIA	2010	Q2
S7	ACM-0071	G2	Enterprise Architecture	Academy	Exploratory Literature Review	1	Propositional	Journal	USA	2007	Q4
S8	ACM-0082	G2	Lean-Government	Industry	Mixed: Exploratory Literature Review, Case Study (two)	3	Empirical	Conference	THE NETHERLANDS	2011	Q4
S9	ACM-0083	G1	SOA Governance	Academy	Exploratory Analysis	1	Expert opinion	Conference	AUSTRALIA	2008	Q4
S10	ACM-0093	G3	Agile Manufacturing	Academy	Exploratory Analysis	1	Expert opinion	Journal	PORTUGAL	2011	Q4
S11	ACM-0097	G1	Software Development Governance	Industry	Case Study	1	Empirical	Journal	DENMARK	2009	Q1
S12	ACM-0149	G2	Enterprise Architecture	Academy	Exploratory Analysis	1	Expert opinion	Conference	IRAN	2010	Q4
S13	ACM-0154	G1	SOA Governance	Academy	Exploratory Analysis	1	Expert opinion	Magazine	UAE	2007	Q4
S14	ACM-0188	G2	Enterprise Architecture	Industry	Case Study	1	Expert opinion	Conference	IRELAND	2011	Q4
S15	ACM-0189	G2	Enterprise Architecture	Academy	Mixed: Survey, Experiment	2	Empirical	Journal	USA	2009	Q1
S16	ACM-0204	G4	Service Governance	Academy	Case Study	1	Expert opinion	Journal	USA	2011	Q4
S17	ACM-0209	G1	Governance for Agile Software Development	Academy	Mixed: Exploratory Literature Review, Workshop	2	Expert opinion	Journal	IRELAND	2009	Q4
S18	ACM-0212	G2	Agile Public Administration	Academy	Exploratory Analysis	1	Expert opinion	Conference	POLAND	2010	Q4
S19	ACM-0215	G1	SOA Governance	Industry	Exploratory Analysis	1	Propositional	Journal	USA	2008	Q3
S20	ACM-0220	G1	Governance for Agile Software Development	Industry	Exploratory Analysis	1	Expert opinion	Conference	CANADA	2010	Q3
S21	GOP-0129	G2	Agile Enterprise	Industry	Survey	1	Empirical	Conference	GERMANY	2011	Q1
S22	GOS-063	G1	Governance for Agile Software Development	Academy	Case Study	1	Expert opinion	Conference	AUSTRALIA	2007	Q2
S23	GOS-069	G2	Enterprise Architecture	Academy	Case Study	1	Expert opinion	Conference	FINLAND	2009	Q4
S24	I3E-0002	G3	Agile Supply Chain	Academy	Exploratory Literature Review	1	Expert opinion	Conference	AUSTRIA	2007	Q4
S25	I3E-0006	G2	Agile Public Administration	Academy	Exploratory Analysis	1	Expert opinion	Conference	USA	1996	Q4
S26	I3E-0010	G3	Agile Supply Chain	Academy	Exploratory Analysis	1	Propositional	Conference	CHINA	2011	Q3
S27	I3E-0011	G1	Software Development Governance	Industry	Case Study	2	Empirical	Journal	USA	2007	Q1
S28	I3E-0024	G3	Agile Manufacturing	Academy	Case Study	1	Propositional	Conference	UK	2005	Q1
S29	I3E-0025	G3	Agile Supply Chain	Academy	Exploratory Analysis	1	Propositional	Conference	CHINA	2010	Q4
S30	I3E-0027	G3	Agile Manufacturing	Academy	Exploratory Literature Review	1	Expert opinion	Conference	USA	2009	Q4
S31	I3E-0028	G2	Agile Enterprise	Academy	Exploratory Analysis	1	Propositional	Conference	POLAND	2006	Q4

Study	ID	Group	Category	Research Nature	Methodology	Study approach	Study Type	Reference Type	Country	Year	Quadrant
S32	I3E-0029	G3	Agile Manufacturing	Industry	Exploratory Analysis	1	Expert opinion	Conference	UK	2004	Q4
S33	I3E-0037	G3	Agile Manufacturing	Industry	Survey	1	Empirical	Conference	UK	1997	Q4
S34	I3E-0045	G3	Agile Supply Chain	Academy	Exploratory Literature Review	1	Propositional	Conference	PORTUGAL	2011	Q4
S35	I3E-0050	G3	Agile Supply Chain	Industry	Exploratory Analysis	1	Propositional	Conference	CHINA	2010	Q4
S36	I3E-0052	G2	Enterprise Architecture	Academy	Exploratory Analysis	1	Expert opinion	Conference	THE NETHERLANDS	2011	Q4
S37	I3E-0054	G2	Enterprise Architecture	Academy	Exploratory Analysis	1	Propositional	Conference	GERMANY	2005	Q3
S38	I3E-0063	G2	Agile Enterprise	Academy	Exploratory Analysis	1	Propositional	Conference	IRELAND	2007	Q4
S39	I3E-0084	G3	Agile Manufacturing	Academy	Exploratory Analysis	1	Propositional	Conference	UK	2004	Q3
S40	I3E-0088	G3	Agile Supply Chain	Academy	Exploratory Literature Review	1	Propositional	Conference	UK	2007	Q3
S41	I3E-0109	G1	SOA Governance	Academy	Exploratory Analysis	1	Expert opinion	Conference	CHINA	2008	Q3
S42	I3E-0120	G4	Agile Projects and Portfolio Governance	Academy	Exploratory Analysis	1	Propositional	Conference	USA	2011	Q3
S43	I3E-0125	G3	Agile Manufacturing	Academy	Exploratory Literature Review	1	Propositional	Conference	ITALY	2007	Q3
S44	I3E-0130	G4	Agile Projects and Portfolio Governance	Academy	Exploratory Analysis	1	Propositional	Conference	FRANCE	2010	Q3
S45	I3E-0137	G2	e-Government	Industry	Case Study	1	Propositional	Conference	PORTUGAL	2011	Q2
S46	I3E-0140	G1	SOA Governance	Industry	Case Study	1	Expert opinion	Conference	CROATIA	2010	Q3
S47	I3E-0147	G3	Agile Supply Chain	Academy	Survey	1	Propositional	Conference	CHINA	2010	Q3
S48	I3E-0148	G3	Agile Manufacturing	Academy	Exploratory Analysis	1	Propositional	Conference	CHINA	2009	Q3
S49	I3E-0156	G3	Agile Manufacturing	Academy	Exploratory Analysis	1	Propositional	Conference	PAKISTAN	2002	Q3
S50	I3E-0173	G2	Enterprise Architecture	Academy	Exploratory Analysis	1	Expert opinion	Conference	CHINA	2010	Q3
S51	I3E-0192	G3	Lean Manufacturing	Academy	Exploratory Literature Review	1	Propositional	Conference	MALAYSIA	2010	Q3
S52	I3E-0213	G2	Agile Enterprise	Academy	Exploratory Analysis	1	Propositional	Conference	CHINA	2011	Q3
S53	I3E-0232	G1	Software Development Governance	Academy	Exploratory Analysis	1	Propositional	Conference	FRANCE	2009	Q3
S54	POP-001	G1	Governance for Agile Software Development	Academy	Survey	1	Expert opinion	Conference	AUSTRALIA	2007	Q4
S55	POP-002	G4	Lean Governance	Industry	Exploratory Analysis	1	Propositional	Conference	CANADA	2009	Q4
S56	POP-003	G1	SOA Governance	Industry	Exploratory Analysis	1	Propositional	Conference	CANADA	2008	Q4
S57	POP-005	G4	Service Governance	Industry	Exploratory Analysis	1	Propositional	Conference	UK	2009	Q3
S58	POP-007	G4	Lean Governance	Industry	Case Study	2	Application	Conference	INDIA	2007	Q3
S59	POP-008	G1	SOA Governance	Academy	Exploratory Analysis	1	Propositional	Conference	FRANCE	2010	Q4
S60	POP-009	G4	Agile IT Governance	Academy	Mixed: Exploratory Literature Review, Survey	2	Empirical	Journal	BRAZIL	2010	Q1
S61	POP-010	G1	SOA Governance	Academy	Exploratory Analysis	1	Propositional	Conference	FINLAND	2009	Q4
S62	POP-013	G2	Enterprise Architecture	Academy	Mixed: Expert interviews, Exploratory Literature Review	2	Empirical	Conference	GERMANY	2009	Q1
S63	POP-015	G1	Governance for Agile Software Development	Industry	Case Study	3	Empirical	Conference	THE NETHERLANDS	2009	Q1
S64	POP-016	G1	SOA Governance	Academy	Case Study	1	Application	Conference	AUSTRALIA	2007	Q4
S65	POP-018	G2	e-Government	Industry	Exploratory Analysis	1	Propositional	Conference	FRANCE	2011	Q4
S66	POP-022	G4	Agile Projects and Portfolio Governance	Industry	Survey	1	Empirical	Conference	UK	2010	Q1
S67	POP-023	G2	e-Government	Industry	Exploratory Analysis	1	Propositional	Conference	FRANCE	2011	Q4
S68	POP-029	G4	Lean Governance	Industry	Exploratory Analysis	1	Propositional	Conference	USA	2004	Q3
S69	POP-030	G1	Governance for Agile Software Development	Academy	Exploratory Analysis	1	Expert opinion	Conference	IRELAND	2011	Q3
S70	POP-036	G2	Enterprise Architecture	Academy	Exploratory Analysis	1	Expert opinion	Conference	IRAN	2010	Q3
S71	POP-038	G1	Software Development Governance	Academy	Workshop	1	Expert opinion	Conference	ISRAEL	2009	Q4
S72	POP-039	G1	Governance for Agile Software	Industry	Mixed: Analytic Hierarchy	2	Empirical	Journal	USA	2009	Q1

Study	ID	Group	Category	Research Nature	Methodology	Study approach	Study Type	Reference Type	Country	Year	Quadrant
			Development		Process (AHP) technique, Expert interviews						
S73	POP-040	G1	Governance for Agile Software Development	Industry	Case Study	1	Empirical	Conference	ISRAEL	2009	Q1
S74	POP-047	G1	Software Development Governance	Academy	Workshop	1	Expert opinion	Conference	ISRAEL	2010	Q4
S75	POP-054	G1	Governance for Agile Software Development	Industry	Case Study	2	Empirical	Journal	AUSTRALIA	2008	Q1
S76	POP-058	G2	Enterprise Architecture	Academy	Exploratory Literature Review	1	Propositional	Conference	THE NETHERLANDS	2008	Q1
S77	POP-066	G1	Governance for Agile Software Development	Industry	Exploratory Analysis	1	Expert opinion	Conference	AUSTRALIA	2009	Q3
S78	POP-071	G2	e-Government	Industry	Mixed: Case Study, Non-evidenced Experiment	2	Expert opinion	Journal	ITALY	2011	Q3
S79	POP-073	G2	Enterprise Architecture	Industry	Experience Report	1	Expert opinion	Journal	USA	2006	Q4
S80	SCD-0013	G1	Governance for Agile Software Development	Academy	Case Study	1	Empirical	Journal	IRELAND	2011	Q2
S81	SCD-0014	G3	Agile Manufacturing	Academy	Case Study	1	Empirical	Journal	SWEDEN	2011	Q4
S82	SCD-0017	G1	SOA Governance	Academy	Exploratory Literature Review	1	Propositional	Journal	USA	2008	Q2
S83	SCD-0018	G4	Agile IT Governance	Academy	Survey	1	Empirical	Journal	AUSTRALIA	2010	Q1
S84	SCD-0022	G2	Enterprise Architecture	Academy	Exploratory Analysis	1	Empirical	Journal	FINLAND	2010	Q1
S85	SCD-0063	G2	Agile Public Administration	Academy	Mixed: Exploratory Analysis, Case Study, Survey	3	Expert opinion	Journal	USA	2006	Q4
S86	SCD-0069	G3	Agile Manufacturing	Industry	Case Study	1	Expert opinion	Journal	TAIWAN	2008	Q4
S87	SCI-0085	G2	Agile Enterprise	Industry	Mixed: Case Study (five), Survey	6	Empirical	Journal	UK	2009	Q1
S88	SCI-0094	G2	Agile Enterprise	Academy	Survey	1	Empirical	Journal	SPAIN	2011	Q1
S89	SCI-0101	G3	Agile Supply Chain	Academy	Case Study	1	Propositional	Journal	USA	2008	Q4
S90	SCO-001	G2	Enterprise Architecture	Academy	Mixed: Process DNA, Quality Genes approaches	2	Expert opinion	Journal	USA	2011	Q4
S91	SCO-002	G1	Software Development Governance	Industry	Case Study	2	Expert opinion	Conference	INDIA	2011	Q4
S92	SCO-006	G1	Software Development Governance	Academy	Exploratory Analysis	1	Expert opinion	Journal	CANADA	2011	Q4
S93	SCO-011	G2	Agile Public Administration	Academy	Mixed: Interviews, Questionnaires	2	Empirical	Journal	UK	2011	Q1
S94	SCO-020	G1	SOA Governance	Academy	Exploratory Analysis	1	Propositional	Conference	BANGLADESH	2010	Q3
S95	SCO-023	G2	e-Government	Academy	Exploratory Analysis	1	Propositional	Conference	BANGLADESH	2010	Q3
S96	SCO-024	G4	Service Governance	Industry	Case Study	1	Application	Conference	USA	2010	Q4
S97	SCO-026	G1	Software Process Improvement (SPI) Agility	Industry	Factor Analysis	1	Empirical	Conference	UK	2010	Q1
S98	SCO-030	G1	SOA Governance	Academy	Exploratory Literature Review	1	Propositional	Conference	SWITZERLAND	2010	Q4
S99	SCO-057	G1	Software Development Governance	Industry	Case Study	1	Empirical	Conference	FINLAND	2009	Q1
S100	SCO-061	G1	Software Development Governance	Academy	Exploratory Analysis	1	Propositional	Journal	USA	2009	Q3
S101	SCO-067	G4	Agile Projects and Portfolio Governance	Academy	Exploratory Analysis	1	Expert opinion	Journal	CANADA	2009	Q3
S102	SCO-076	G2	e-Government	Academy	Workshop	1	Propositional	Conference	USA	2008	Q4
S103	SCO-080	G4	Agile Projects and Portfolio Governance	Industry	Exploratory Analysis	1	Expert opinion	Conference	CANADA	2008	Q3
S104	SCO-081	G1	SOA Governance	Academy	Exploratory Analysis	1	Expert opinion	Conference	GERMANY	2008	Q4
S105	SCO-082	G1	SOA Governance	Academy	Exploratory Analysis	1	Propositional	Conference	GERMANY	2008	Q4
S106	SCO-090	G2	Agile Enterprise	Industry	Mixed: Exploratory Literature Review, Survey	2	Empirical	Journal	USA	2008	Q1
S107	SCO-096	G1	Software Development Governance	Academy	Case Study	1	Propositional	Conference	CHINA	2007	Q3

Study	ID	Group	Category	Research Nature	Methodology	Study approach	Study Type	Reference Type	Country	Year	Quadrant
S108	SCO-104	G1	Software Process Improvement (SPI) Agility	Industry	Case Study	1	Expert opinion	Journal	DENMARK	2007	Q1
S109	SCO-111	G1	Software Development Governance	Industry	Case Study	1	Application	Conference	UK	2006	Q3
S110	SCO-114	G1	Software Development Governance	Industry	Case Study	1	Application	Conference	USA	2006	Q3
S111	SCO-123	G4	Agile Projects and Portfolio Governance	Academy	Exploratory Analysis	1	Propositional	Journal	USA	2006	Q4
S112	SCO-125	G1	Governance for Agile Software Development	Industry	Experience Report	1	Expert opinion	Conference	USA	2005	Q3
S113	SCO-145	G2	Agile Enterprise	Industry	Exploratory Analysis	1	Expert opinion	Journal	USA	1996	Q3
S114	SPL-0035	G2	Enterprise Architecture	Academy	Case Study	1	Empirical	Journal	USA	2007	Q1
S115	SPL-0045	G2	Enterprise Architecture	Industry	Exploratory Analysis	1	Propositional	Journal	USA	2006	Q4
S116	SPL-0075	G2	Enterprise Architecture	Industry	Exploratory Analysis	1	Propositional	Journal	UK	2005	Q3
S117	SPL-0092	G2	Agile Enterprise	Industry	Exploratory Analysis	1	Expert opinion	Journal	UK	1999	Q4
S118	SPL-0116	G4	Service Governance	Academy	Mixed: Analytic Hierarchy Process (AHP) technique, Fuzzy Analytic Network Process (FANP)	2	Empirical	Journal	TAIWAN	2007	Q4
S119	SPL-0120	G2	Enterprise Architecture	Academy	Exploratory Literature Review	1	Propositional	Journal	GERMANY	2001	Q4
S120	SPL-0128	G2	Agile Enterprise	Academy	Exploratory Literature Review	1	Expert opinion	Journal	USA	2007	Q4
S121	SPL-0131	G3	Agile Manufacturing	Academy	Exploratory Analysis	1	Expert opinion	Journal	CANADA	2002	Q2
S122	GOP-E1-012	G1	Governance for Agile Software Development	Industry	Experience Report	1	Expert opinion	Journal	CANADA	2013	Q3
S123	GOS-E1-065	G2	Enterprise Architecture	Industry	Survey	1	Propositional	Journal	UK	2012	Q4
S124	I3E-E1-061	G4	Agile IT Governance	Industry	Exploratory Analysis	1	Expert opinion	Magazine	USA	2012	Q4
S125	SCO-E1-071	G1	Software Development Governance	Industry	Mixed: Exploratory Literature Review, Case Study (two)	3	Application	Journal	THE NETHERLANDS	2012	Q3
S126	POP-E1-072	G2	Agile Enterprise	Industry	Mixed: Exploratory Literature Review, Exploratory Case Study Analysis	2	Propositional	Conference	GERMANY	2013	Q1
S127	SCO-E1-054	G4	Lean Governance	Academy	Exploratory Analysis	1	Propositional	Conference	AUSTRALIA	2012	Q4
S128	ISI-E1-006	G2	Agile Public Administration	Industry	Exploratory Analysis	1	Propositional	Journal	UK	2013	Q4
S129	SCO-E1-043	G2	Agile Enterprise	Academy	Exploratory Analysis	1	Propositional	Conference	SWEDEN	2013	Q3
S130	SCD-E1-026	G2	e-Government	Academy	Exploratory Analysis	1	Application	Journal	FRANCE	2013	Q3
S131	I3E-E1-021	G4	Agile IT Governance	Industry	Survey	1	Empirical	Conference	FRANCE	2013	Q4
S132	ACM-E1-015	G1	Governance for Agile Software Development	Industry	Exploratory Analysis	1	Expert opinion	Conference	UK	2013	Q4
S133	I3E-E1-140	G2	e-Government	Industry	Exploratory Analysis	1	Expert opinion	Conference	INDIA	2012	Q3
S134	GOS-E1-087	G2	Enterprise Architecture	Industry	Exploratory Analysis	1	Expert opinion	Conference	INDIA	2013	Q3
S135	ACM-E1-016	G2	Enterprise Architecture	Academy	Exploratory Analysis	1	Propositional	Conference	ETHIOPIA	2012	Q4
S136	SCO-E1-070	G1	Software Development Governance	Industry	Case Study	1	Empirical	Conference	ISRAEL	2012	Q1
S137	POP-085	G1	Software Development Governance	Industry	Mixed: Survey, Factor Analysis	2	Empirical	Conference	ISRAEL	2011	Q1
S138	I3E-E1-032	G1	Governance for Agile Software Development	Academy	Exploratory Analysis	1	Propositional	Conference	COLOMBIA	2012	Q3
S139	SCO-E1-055	G4	Lean Governance	Industry	Exploratory Analysis	1	Propositional	Conference	USA	2012	Q3
S140	I3E-E1-043	G1	SOA Governance	Academy	Exploratory Analysis	1	Propositional	Conference	BRAZIL	2012	Q4
S141	SCO-E1-022	G1	Governance for Agile Software Development	Academy	Grounded Theory	1	Empirical	Journal	IRAN	2013	Q4
S142	ISI-E1-021	G2	e-Government	Academy	Case Study	1	Propositional	Journal	THE NETHERLANDS	2012	Q1

Study	ID	Group	Category	Research Nature	Methodology	Study approach	Study Type	Reference Type	Country	Year	Quadrant
S143	SCD-E1-017	G1	SOA Governance	Academy	Exploratory Analysis	1	Propositional	Journal	FRANCE	2013	Q4
S144	GOS-E1-003	G1	SOA Governance	Academy	Exploratory Literature Review	1	Expert opinion	Journal	INDIA	2013	Q4
S145	I3E-E1-037	G4	Agile IT Governance	Industry	Survey	1	Empirical	Conference	FRANCE	2012	Q1
S146	ISI-E1-022	G2	Agile Enterprise	Academy	Exploratory Analysis	1	Propositional	Journal	ALGERIA	2012	Q4
S147	ISI-E1-009	G2	Lean-Government	Academy	Exploratory Literature Review	1	Expert opinion	Journal	THE NETHERLANDS	2013	Q1
S148	I3E-E1-114	G2	Agile Public Administration	Industry	Case Study	1	Empirical	Conference	USA	2012	Q4
S149	SPL-E1-001	G4	Service Governance	Academy	Exploratory Analysis	1	Propositional	Journal	AUSTRIA	2012	Q4
S150	I3E-E1-001	G4	Agile IT Governance	Academy	Mixed: Systematic Literature Review, Inductive approach, Comparative and structuralistic procedures	3	Propositional	Conference	BRAZIL	2013	Q4
S151	GOP-E1-089	G1	Governance for Agile Software Development	Industry	Case Study	1	Application	Magazine	FINLAND	2013	Q3
S152	ISI-E1-019	G2	Enterprise Architecture	Academy	Survey	1	Empirical	Journal	USA	2012	Q1
S153	ACM-E1-027	G2	Agile Public Administration	Industry	Case Study	1	Application	Conference	USA	2013	Q4
S154	I3E-E1-040	G2	Agile Enterprise	Industry	Case Study	1	Expert opinion	Conference	FRANCE	2012	Q1
S155	SCD-E1-028	G1	SOA Governance	Academy	Exploratory Analysis	1	Propositional	Journal	GERMANY	2012	Q4
S156	GOP-E1-071	G2	Agile Public Administration	Academy	Workshop	1	Propositional	Conference	ITALY	2013	Q4
S157	I3E-E1-044	G1	SOA Governance	Industry	Exploratory Analysis	1	Propositional	Conference	FRANCE	2013	Q3
S158	I3E-E1-036	G2	Enterprise Architecture	Academy	Case Study	1	Propositional	Conference	ITALY	2012	Q3
S159	I3E-E1-041	G4	Agile IT Governance	Industry	Exploratory Analysis	1	Propositional	Conference	USA	2012	Q3
S160	I3E-E1-142	G1	Software Development Governance	Academy	Case Study	1	Application	Conference	THE NETHERLANDS	2012	Q4
S161	SCI-E1-032	G4	Agile Enterprise	Academy	Mixed: Case Study, Interviews, Workshop, Survey	1	Empirical	Conference	USA	2011	Q1
S162	SCO-E1-015	G2	Agile Public Administration	Academy	Case Study	1	Propositional	Journal	UK	2013	Q4
S163	I3E-E1-005	G1	Governance for Agile Software Development	Industry	Exploratory Analysis	1	Propositional	Journal	USA	2013	Q4
S164	I3E-E1-152	G1	SOA Governance	Academy	Exploratory Analysis	1	Propositional	Conference	AUSTRALIA	2012	Q4
S165	SCO-E1-078	G1	Governance for Agile Software Development	Academy	Exploratory Literature Review	1	Empirical	Journal	ITALY	2012	Q1
S166	ISI-E1-024	G2	Agile Enterprise	Academy	Mixed: Structural Equation Modeling (SEM), Confirmatory Factor Analysis (CFA), Survey	3	Empirical	Journal	TAIWAN	2012	Q1
S167	I3E-E1-087	G2	Enterprise Architecture	Academy	Mixed: Exploratory Analysis, Case Study (seven)	8	Propositional	Conference	GERMANY	2012	Q4

APPENDIX I.6. SLR: Overview of Quality Assessment

Study	ID	QA01	QA02	QA03	QA04	QA05	QA06	QA07	QA08	QA09	QA10	QA11	QA12	QA13	Quality Score
S1	ACM-0025	1	1	1	0	0	0	0	0	0	0	1	1	0	**5**
S2	ACM-0034	1	1	1	0	0	1	0	0	0	1	0	1	1	**7**
S3	ACM-0035	2	2	1	1	1	0	0	0	0	1	0	1	1	**10**
S4	ACM-0040	2	2	2	1	1	1	0	0	0	1	1	1	0	**12**
S5	ACM-0056	1	1	1	1	0	0	0	0	1	1	0	1	0	**7**
S6	ACM-0057	2	2	2	1	1	0	1	1	1	1	0	1	1	**14**
S7	ACM-0071	2	2	2	1	1	0	0	0	1	1	1	1	0	**12**
S8	ACM-0082	1	1	1	1	2	1	1	1	0	1	0	1	0	**11**
S9	ACM-0083	2	2	2	0	0	0	0	0	0	1	0	1	0	**8**
S10	ACM-0093	2	2	2	0	0	0	0	1	0	2	1	2	1	**13**
S11	ACM-0097	1	1	2	2	2	1	1	1	1	1	0	1	1	**15**
S12	ACM-0149	1	1	0	1	0	0	0	0	0	0	0	1	1	**5**
S13	ACM-0154	2	2	1	1	1	0	0	0	1	1	0	1	0	**10**
S14	ACM-0188	1	1	0	1	1	1	2	0	1	1	0	1	0	**10**
S15	ACM-0189	2	2	1	2	2	1	2	2	1	1	0	2	2	**20**
S16	ACM-0204	2	1	1	0	1	1	1	1	0	1	1	1	0	**11**
S17	ACM-0209	2	2	1	0	1	1	1	1	1	1	0	2	0	**13**
S18	ACM-0212	2	2	1	0	0	0	0	0	1	1	0	1	0	**8**
S19	ACM-0215	2	1	2	1	0	0	0	0	1	1	0	1	0	**9**
S20	ACM-0220	2	2	1	0	1	0	0	0	0	1	0	1	0	**8**
S21	GOP-0129	2	2	2	2	2	1	1	2	1	1	1	1	1	**19**
S22	GOS-063	2	2	1	1	1	1	1	1	1	1	0	2	0	**14**
S23	GOS-069	2	2	1	1	1	0	1	1	1	1	1	1	0	**13**
S24	I3E-0002	2	2	2	1	1	0	0	0	1	1	1	1	0	**12**
S25	I3E-0006	2	2	2	0	0	0	0	1	0	1	1	1	0	**10**
S26	I3E-0010	1	1	1	0	1	0	0	0	1	1	0	1	0	**7**
S27	I3E-0011	2	2	2	2	2	2	2	1	1	1	0	1	1	**19**
S28	I3E-0024	2	2	2	1	1	1	1	1	1	1	0	1	1	**15**
S29	I3E-0025	2	1	1	0	0	0	0	0	1	1	0	1	0	**7**
S30	I3E-0027	1	1	1	1	1	0	0	0	1	1	1	1	1	**10**
S31	I3E-0028	1	0	1	0	0	0	0	0	0	1	1	1	0	**5**
S32	I3E-0029	1	1	1	1	0	0	0	0	0	1	0	0	0	**5**
S33	I3E-0037	1	1	1	1	1	1	1	0	1	1	0	1	0	**10**
S34	I3E-0045	1	1	1	0	0	0	0	0	1	1	0	1	0	**6**
S35	I3E-0050	1	1	1	0	0	0	0	0	0	1	1	1	0	**6**
S36	I3E-0052	2	2	2	0	1	0	0	0	0	1	1	1	0	**10**
S37	I3E-0054	1	1	1	0	0	0	0	0	0	1	0	1	0	**5**
S38	I3E-0063	2	1	1	0	0	0	0	0	1	1	0	1	0	**7**
S39	I3E-0084	2	1	1	0	0	0	0	0	0	1	1	1	0	**7**
S40	I3E-0088	2	1	1	0	1	0	0	0	1	1	0	1	0	**8**
S41	I3E-0109	2	1	0	0	0	0	0	0	0	1	0	0	0	**4**
S42	I3E-0120	2	1	1	2	1	0	0	0	2	1	0	1	0	**11**
S43	I3E-0125	2	2	2	0	1	0	0	0	2	1	1	1	0	**12**
S44	I3E-0130	2	2	1	1	0	0	0	0	0	1	1	1	0	**9**
S45	I3E-0137	2	2	1	2	2	0	0	1	1	1	0	2	1	**15**
S46	I3E-0140	2	2	1	0	1	0	0	0	1	1	0	1	0	**9**
S47	I3E-0147	2	1	1	0	1	1	1	2	0	1	0	1	0	**11**
S48	I3E-0148	2	2	1	0	0	0	0	0	1	1	0	1	0	**8**
S49	I3E-0156	2	1	1	0	0	0	0	0	0	1	0	1	0	**6**
S50	I3E-0173	1	1	1	0	0	0	0	0	0	1	0	0	0	**4**
S51	I3E-0192	1	1	1	1	0	0	0	0	0	0	1	0	0	**5**
S52	I3E-0213	1	0	1	0	0	0	0	0	0	0	1	1	0	**4**
S53	I3E-0232	2	1	2	1	1	0	0	0	1	1	0	1	0	**10**
S54	POP-001	2	1	1	0	1	1	0	0	0	1	2	1	0	**10**
S55	POP-002	1	1	1	1	0	0	0	0	1	1	1	2	0	**9**
S56	POP-003	2	1	1	1	0	0	0	0	1	1	1	1	0	**9**
S57	POP-005	2	1	1	0	0	0	0	0	0	1	0	1	0	**6**
S58	POP-007	2	1	1	0	0	0	1	0	0	1	0	1	0	**7**
S59	POP-008	2	2	2	1	1	0	0	0	1	2	0	2	0	**13**
S60	POP-009	2	2	2	1	2	2	1	2	1	2	2	1	1	**21**
S61	POP-010	2	1	1	1	1	0	0	0	1	2	0	1	0	**10**
S62	POP-013	2	2	2	0	2	1	0	0	0	2	0	2	1	**14**
S63	POP-015	2	2	1	1	2	1	1	1	1	1	2	1	1	**17**
S64	POP-016	2	2	2	0	1	1	0	0	1	1	0	1	0	**11**
S65	POP-018	2	2	1	0	1	0	0	0	0	1	1	2	0	**10**

Study	ID	QA01	QA02	QA03	QA04	QA05	QA06	QA07	QA08	QA09	QA10	QA11	QA12	QA13	Quality Score
S66	POP-022	2	1	1	1	2	1	2	2	1	1	0	2	2	**18**
S67	POP-023	2	2	2	0	1	0	0	0	0	1	0	1	0	**9**
S68	POP-029	1	1	1	0	0	0	0	0	0	1	0	1	0	**5**
S69	POP-030	1	1	1	2	1	1	1	1	0	0	0	0	0	**9**
S70	POP-036	1	1	1	1	1	0	1	0	1	1	0	1	0	**9**
S71	POP-038	1	1	1	0	1	1	0	0	1	1	1	1	0	**9**
S72	POP-039	2	1	2	2	1	1	1	1	1	1	1	1	1	**16**
S73	POP-040	2	2	1	2	1	1	1	1	2	2	0	2	0	**17**
S74	POP-047	2	1	1	0	1	0	0	0	0	1	1	1	0	**8**
S75	POP-054	2	2	2	1	2	1	1	1	1	2	2	2	1	**20**
S76	POP-058	2	2	2	1	0	0	0	0	2	2	1	2	1	**15**
S77	POP-066	1	1	0	0	0	0	0	0	0	1	0	1	0	**4**
S78	POP-071	2	2	1	0	1	0	1	0	0	0	0	1	0	**8**
S79	POP-073	2	2	1	0	0	0	0	0	0	1	0	2	0	**8**
S80	SCD-0013	2	2	2	1	2	0	1	0	1	1	0	2	0	**14**
S81	SCD-0014	2	2	2	1	1	0	1	0	1	1	0	2	0	**13**
S82	SCD-0017	2	2	2	2	1	0	0	0	2	2	0	2	0	**15**
S83	SCD-0018	2	2	1	2	2	2	2	1	1	1	0	1	2	**19**
S84	SCD-0022	2	2	2	1	1	1	1	0	1	2	0	2	0	**15**
S85	SCD-0063	2	1	1	2	1	1	0	0	0	1	0	1	0	**10**
S86	SCD-0069	2	2	1	2	1	1	1	0	1	1	0	1	0	**13**
S87	SCI-0085	2	2	2	1	1	2	2	2	1	2	1	1	0	**19**
S88	SCI-0094	2	2	2	1	2	2	2	2	1	2	0	2	2	**22**
S89	SCI-0101	2	1	2	0	1	1	1	0	1	1	1	1	0	**12**
S90	SCO-001	2	2	2	1	1	1	1	0	0	1	0	0	0	**11**
S91	SCO-002	2	2	1	0	1	0	1	0	0	1	0	1	0	**9**
S92	SCO-006	2	2	2	0	1	0	0	1	0	1	1	2	0	**12**
S93	SCO-011	2	2	2	1	1	1	1	1	1	1	0	1	0	**14**
S94	SCO-020	2	2	1	0	1	0	0	0	0	1	1	1	0	**9**
S95	SCO-023	1	1	0	0	0	0	0	0	0	1	0	1	0	**4**
S96	SCO-024	1	1	0	0	1	1	1	0	0	1	0	1	0	**7**
S97	SCO-026	2	1	1	1	2	1	2	2	1	1	0	1	2	**17**
S98	SCO-030	2	2	2	0	0	0	0	0	0	2	1	1	0	**10**
S99	SCO-057	2	2	1	0	2	1	2	1	1	1	0	1	0	**14**
S100	SCO-061	2	2	1	0	0	0	0	0	0	1	0	1	0	**7**
S101	SCO-067	2	2	2	0	0	0	0	0	1	1	0	1	0	**9**
S102	SCO-076	2	1	1	0	1	0	0	0	0	1	1	1	0	**8**
S103	SCO-080	2	2	1	0	1	0	0	1	1	1	0	1	0	**10**
S104	SCO-081	2	2	1	1	0	0	0	0	1	1	1	1	0	**10**
S105	SCO-082	2	2	2	0	0	0	0	0	0	2	0	2	0	**10**
S106	SCO-090	2	1	2	2	1	1	1	2	2	1	0	2	2	**19**
S107	SCO-096	1	1	1	0	1	0	0	0	0	0	0	0	0	**4**
S108	SCO-104	2	2	1	2	1	1	1	1	1	1	0	1	0	**14**
S109	SCO-111	1	1	1	0	0	0	0	0	0	1	0	0	0	**4**
S110	SCO-114	2	1	1	0	0	0	0	0	0	1	0	1	0	**6**
S111	SCO-123	2	2	1	0	0	0	0	0	0	2	0	2	0	**9**
S112	SCO-125	1	1	1	0	0	1	0	0	0	1	0	1	0	**6**
S113	SCO-145	2	2	1	0	0	0	1	0	1	1	1	1	0	**10**
S114	SPL-0035	2	2	2	2	2	2	1	2	1	1	0	2	1	**20**
S115	SPL-0045	2	2	1	0	0	0	0	0	0	1	0	1	0	**7**
S116	SPL-0075	2	2	1	0	0	0	0	0	0	1	0	1	0	**7**
S117	SPL-0092	2	2	1	0	0	0	0	0	1	1	1	1	0	**9**
S118	SPL-0116	2	2	1	0	1	1	1	2	0	1	0	1	1	**13**
S119	SPL-0120	2	2	1	2	1	0	0	0	1	1	0	1	0	**11**
S120	SPL-0128	2	2	2	1	0	0	0	0	1	2	0	2	0	**12**
S121	SPL-0131	2	2	2	1	1	0	1	1	1	1	1	1	0	**14**
S122	GOP-E1-012	1	1	1	0	0	1	1	0	0	1	0	1	0	**7**
S123	GOS-E1-065	1	2	1	1	1	0	0	0	0	1	0	1	0	**8**
S124	I3E-E1-061	1	1	1	0	0	0	0	0	0	1	0	1	0	**5**
S125	SCO-E1-071	1	1	1	0	1	1	1	1	0	1	0	0	0	**8**
S126	POP-E1-072	1	2	2	2	2	1	1	1	1	1	1	1	1	**17**
S127	SCO-E1-054	1	2	1	0	1	0	0	0	0	2	1	2	0	**10**
S128	ISI-E1-006	2	2	1	0	1	1	1	0	0	1	0	2	1	**12**
S129	SCO-E1-043	1	1	1	2	0	0	0	0	0	0	0	1	0	**6**
S130	SCD-E1-026	2	2	2	0	0	0	0	0	1	1	0	1	1	**10**
S131	I3E-E1-021	1	1	1	2	1	1	1	1	1	1	0	1	1	**13**
S132	ACM-E1-015	2	2	1	0	0	0	0	0	0	1	1	2	0	**9**
S133	I3E-E1-140	1	1	0	0	0	0	0	0	0	1	1	1	0	**5**
S134	GOS-E1-087	2	2	1	0	0	0	0	0	0	1	0	2	0	**8**
S135	ACM-E1-016	1	2	1	0	0	0	0	0	0	2	1	2	0	**9**
S136	SCO-E1-070	2	2	2	0	2	1	1	1	0	2	0	1	0	**14**
S137	POP-085	1	1	2	2	1	1	1	1	1	1	1	1	1	**15**
S138	I3E-E1-032	1	1	1	0	0	0	0	0	0	1	0	2	0	**6**

Study	ID	QA01	QA02	QA03	QA04	QA05	QA06	QA07	QA08	QA09	QA10	QA11	QA12	QA13	Quality Score
S139	SCO-E1-055	2	2	1	0	0	0	0	0	0	1	0	1	0	**7**
S140	I3E-E1-043	1	1	0	0	1	0	1	1	0	1	1	1	0	**8**
S141	SCO-E1-022	2	1	1	0	2	1	1	1	0	1	0	1	0	**11**
S142	ISI-E1-021	1	2	1	1	1	1	1	1	1	1	1	1	1	**14**
S143	SCD-E1-017	1	1	1	0	0	0	0	0	0	1	0	2	1	**7**
S144	GOS-E1-003	1	1	1	0	0	0	0	0	0	1	1	1	0	**6**
S145	I3E-E1-037	1	1	1	2	1	1	1	1	1	1	1	1	1	**14**
S146	ISI-E1-022	2	2	2	0	1	0	0	0	0	2	1	2	1	**13**
S147	ISI-E1-009	2	2	2	0	0	2	2	0	0	2	1	2	0	**15**
S148	I3E-E1-114	2	2	1	0	1	0	1	1	0	2	0	2	0	**12**
S149	SPL-E1-001	2	2	2	0	1	0	0	0	0	1	0	2	0	**10**
S150	I3E-E1-001	2	2	1	2	1	1	0	1	0	0	2	0	0	**12**
S151	GOP-E1-089	1	1	1	0	0	0	1	1	0	1	0	1	0	**7**
S152	ISI-E1-019	2	2	1	2	2	2	2	2	2	2	0	1	2	**22**
S153	ACM-E1-027	2	2	1	0	1	1	1	1	1	1	0	2	0	**13**
S154	I3E-E1-040	2	2	1	1	1	1	1	1	1	1	0	2	1	**15**
S155	SCD-E1-028	2	2	2	0	1	0	0	0	0	2	1	2	0	**12**
S156	GOP-E1-071	2	2	2	0	1	1	1	1	0	1	0	2	0	**13**
S157	I3E-E1-044	2	2	1	0	0	0	0	0	0	1	0	2	0	**8**
S158	I3E-E1-036	2	1	1	0	1	0	0	0	0	1	0	1	0	**7**
S159	I3E-E1-041	1	1	1	0	0	0	0	0	0	1	0	2	0	**6**
S160	I3E-E1-142	2	2	1	0	1	1	1	1	0	1	0	1	0	**11**
S161	SCI-E1-032	2	2	1	2	2	2	2	1	2	1	0	1	1	**19**
S162	SCO-E1-015	2	2	1	1	1	1	1	1	1	1	0	1	0	**13**
S163	I3E-E1-005	2	2	1	0	0	0	0	0	0	2	0	2	0	**9**
S164	I3E-E1-152	2	2	1	0	1	1	0	0	0	1	0	1	0	**9**
S165	SCO-E1-078	2	2	1	1	2	1	1	1	1	2	0	2	1	**17**
S166	ISI-E1-024	2	2	1	2	1	1	1	1	2	1	0	2	2	**18**
S167	I3E-E1-087	1	1	1	0	1	1	1	1	0	1	0	1	1	**10**
	Total	**285**	**261**	**209**	**98**	**126**	**74**	**82**	**69**	**89**	**185**	**58**	**203**	**48**	

APPENDIX I.7. SLR: Studies: Contributions, Focus, Sampling and Geography (Q1)

Study	Category	Year	Contribution/Initiative	Focus	Sampling	Geography
S11	Software Development Governance	2009	Investigates how a company is able to respond to an uncertain business environment, upon the follows levels: firm, projects and interactions	Small software firms	Case study on a small Danish software firm	Denmark
S15	Enterprise Architecture	2009	Develops theoretically the idea that IT architecture modularity helps sustain IT alignment by increasing IT agility, and that decentralization of IT Governance strengthens this relationship.	IT Governance	Survey of 223 organizations drawn from Dun and Bradstreet's directory of executives, being the primary respondents MIS directors	USA
S21	Agile Enterprise	2011	Investigates the impact of Grid assimilation in IT operational agility	Operational agility	Survey: featuring IT decision makers from financial institutions in U.S.	USA
S27	Software Development Governance	2007	Investigates the dynamic capabilities in small software firms, using a Haeckel's sense-and-respond framework	Small software firms	Two small Finnish software firms	Finland
S28	Agile Manufacturing	2005	Methodology to assist manufacturing companies to elaborate agility strategies	Small or Medium Enterprise (SME)	Case study in a company that offers services in electronic, mechanical, acoustic and optical technology with a focus on the military, geophysical and logistical support service sectors	UK
S60	Agile IT Governance	2010	Investigates the convergence between success critical factors of governance projects and the principles from Manifesto for Agile Software Development	IT Governance	Survey: 50 weighted responses among graduate students in IT, IT professionals and IT managers.	Brazil
S62	Enterprise Architecture	2010	IT Strategy Implementation Framework (ITSIF) in order to help organizations to implement IT strategies, as well as analyze, monitor and control the results from this strategies	IT Governance	Expert interviews	Not revealed
S63	Governance for Agile Software Development	2009	Conducts three case studies with product software companies	Software development managers	Three Dutch Product Software Companies (PSC)	The Netherlands
S66	Agile Projects and Portfolio Governance	2010	Statistically tested evidence about how quality and success rate are correlated with variables reflecting the organization and aspects of its project's governance	Agile Projects Governance	Survey that collected 129 responses in 2009	Nonspecific
S72	Governance for Agile Software Development	2009	Empirical study to assess the relative contribution of the facets of agility to distributed systems development success on DSD context	Distributed Software Development (DSD)	Eight experts from high-tech companies, such as: Infosys (India), Microsoft (USA), Intec (UK), Deloitte (USA), Federal Government (USA), Agilent (USA), Cap Gemini (France), EMC (USA)	Multinational
S73	Governance for Agile Software Development	2009	Demonstrates a full lifecycle governance model for agile projects	Large-scale enterprise-critical software	Case Study in Israeli Air Force	Israel

Study	Category	Year	Contribution/Initiative	Focus	Sampling	Geography
				project		
S75	Governance for Agile Software Development	2008	Agile Software Solution Framework (ASSF) for assess the degree of agility required and for identify ways to introduce agility into organization, and an Agility Calculation Method.	Agile Software Development	Software product enhancement and executive/ managers assistance/ support	Australia
S76	Enterprise Architecture	2008	Explores the combination of Business Rule Management (BRM) and Enterprise Architecture (EA) in deployment to support governance, and argue for a synthesis between these two approaches.	Corporate Governance	Exploratory proposition for BRM on Agile Governance, by means of EA	Nonspecific
S83	Agile IT Governance	2010	Examines the relationship among the effectiveness of IT steering committee, driven IT governance initiatives, firm's IT management and IT infrastructure related capabilities	IT Governance	Survey: 216 responses from public and private companies worldwide, and from many sectors, such as: banking and finance, transport and logistics.	Multinational
S84	Enterprise Architecture	2010	Reviews the underlying determinants of the following meta-capabilities: strategic sensitivity, leadership unity and resource fluidity. Proposes a list of leadership actions for strategic business agility.	Leadership	Analyze dozen IT companies who were reconceiving their business models - among others, Nokia, easyGroup, HP, SAP and Kone.	Multinational
S87	Agile Enterprise	2009	Introduces seven factor model that depicts the influences of flexibility on organizational effectiveness in e-business environments.	e-Business	Five case studies from several sectors: global financial services; global aerospace and defense; global technology and consulting global business; technology business; and, UK Leisure, Entertainment and Hotel.	Multinational
S88	Agile Enterprise	2011	Presents a set of enablers for strategic flexibility. The study approach can be applied to analyze other antecedents of flexibility and to propose possible studies that consider Quality Management (QM) as an antecedent of other organizational variables.	Strategic Flexibility	Structured interviews in 453 firms from the Spanish National Information Service "ARDAN", covering sectors as: service, hotels, transport, and manufacturing, among others.	Spain
S93	Agile Public Administration	2011	Explores workers' experiences of the impact of lean on work organization and control and provides new insights into developments within contemporary back office clerical work in the British public services.	Public Service	Report analysis about the adoption of lean philosophy on six sites of the Her Majesty's Revenue and Customs (HMRC)	UK
S97	Software Process Improvement (SPI) Agility	2010	Proposes 15 factors to guide agile process improvement.	Agile Process Improvement	Data collected to study the effectiveness of 58 different agile practices, which were conducted since 2006 by (Ambler, 2007).	Multinational
S99	Software Development Governance	2009	Proposes a framework to depict agile product planning and development, as an extension of Scrum	Governance for software products development	Case study in a Finnish company	Finland
S106	Agile Enterprise	2008	Presents a conceptual model to create a flexible IT infrastructure and mediate managerial IT capabilities and agility	Business Process Agility (BPA)	IT and business executives in 241 firms	USA
S108	Software Process Improvement (SPI) Agility	2007	Suggests the combination of agile SPI practices on the project level for employ adaptive governance mechanisms at the corporate level	Software Process Improvement (SPI)	18 projects at Ericsson in Gothenburg	Sweden
S114	Enterprise Architecture	2007	Discusses insights for multi-unit organizations manage system design to support agility through governance mechanisms.	Multi-unit organizations	Case study in an insurance company	USA
S126	Agile Enterprise	2013	Presents a classification scheme for BI agility metrics and develop an indicator system that is designed to support the steering of BI approaches under explicit consideration of agility objectives	BI governance	Exploratory analysis of multiple interviews from 14 case studies on large commercial German organizations covering many sectors, such as: Automotive, Chemical industries, Banking, Transport and logistic, Telecommunication, Insurance and Food industry, among others.	Germany
S136	Software Development Governance	2012	Examines the role of the retrospective practices in large-scale software development projects	Software Process Improvement	Case study in a complex system project of a small-medium company	Israel
S137	Software Development Governance	2011	Reports an empirical survey of team members of global development projects in six companies. Using factor analysis, they classify four governance mechanisms as follows: governance definition, governance enactment, business awareness, and goal achievement.	Global Software Development	A survey was administered to members of 21 global development teams in four large and two small-to-medium firms, employing in their current projects up to 450 employees, getting 205 useful responses, which 31% reported managerial position in the project.	Multinational
S142	e-Government	2012	Proposes principles for creating flexibility and agility when implementing new or revised policies into business processes.	Agile Policy-making	Case Study in the Immigration and Naturalization Service (IND), distributed in nine offices all over the country.	The Netherlands
S145	Agile IT Governance	2012	Introduces a conceptual and operational research model combining research in IT governance, cloud computing, and business/IT alignment.	IT Governance	Survey of 21 European and North American public and private cloud adopters and non-adopters across various industries.	Multinational
S147	Lean-Government	2013	Presents lean government as a new paradigm to do more with less in public sector.	e-Government	Exploratory analysis from eight papers related with the topic "doing more with less", selected from the submission of the 6th International Conference on Theory and Practice of Electronic Governance, ICEGOV2011	Multinational
S152	Enterprise Architecture	2012	Investigates how IT facilitates a firm's customer agility and, in turn, competitive activity.	Information Systems (IS)	Survey on marketing executives of high-tech firms, achieving 188 and 108 respondents, respectively, in first and second stages.	USA
S154	Agile Enterprise	2012	Analyzes in detail the consequences of simultaneous implementation of different process approaches in enterprise, and show the contributions and problems resulting from such implementation especially concerning governance, agility and strategic flexibility	Information Systems Governance	Two years case study in a very large Telecommunication Operator	France
S161	Agile Enterprise	2011	Investigate how IT can be used in organizations to	Firm	Survey: 221 respondents in publicly traded	Not revealed

Study	Category	Year	Contribution/Initiative	Focus	Sampling	Geography
			increase firm performance. Findings denote that commitments are positively correlated to Business Impact from IT, which in turn correlates with higher financial performance.	performance	firms, being senior non-IT (55%) and IT (45%) managers.	
S165	Governance for Agile Software Development	2012	Conducts an experience report analysis about lean software development approaches and how they are applied in agile software development	Lean Software Development	30 experience reports selected on Agile and XP Conferences	Nonspecific
S166	Agile Enterprise	2012	Provide evidence regarding the impact of enterprise agility and network structure on firm performance This study, also exploits the structural hole and network closure to explore the effect of the network structure on firm performance	Network perspective on enterprise agility	Survey from 250 companies in Taiwan's glass industry	Taiwan

APPENDIX I.8. SLR: Emerging Categories, Studies and Constructs (Q1)

		RQ2				RQ3			
Group	**Category**	**Genesis**	**Shortcoming**	**Evolution**	**Trend**	**Concept**	**Principle**	**Value**	**Practice**
G1	**Governance for Agile Software Development**	[S63]	[S72] [S75]	[S63] [S75]	[S72] [S73]	[S63] [S72]	[S165]		[S63] [S72] [S165]
	Software Development Governance		[S11] [S99] [S136]	[S136]	[S27]		[S11] [S27] [S99]	[S11] [S27]	[S11] [S99] [S136]
	Software Process Improvement (SPI) Agility		[S97] [S108]	[S97]	[S97]	[S108]	[S108]		[S97] [S108]
G2	**Agile Enterprise**	[S166]	[S21] [S87] [S106] [S126] [S154] [S166]	[S21] [S154]	[S21] [S87] [S126] [S166]	[S21] [S87] [S88] [S106] [S126] [S154] [S166]	[S126] [S154]	[S126]	[S88]
	Agile IT Governance	[S60]							
	Agile Public Administration	[S93]		[S93]	[S93]	[S93]			
	e-Government		[S142]	[S142]		[S142]	[S142]	[S142]	
	Enterprise Architecture		[S15] [S62] [S76] [S84] [S152]	[S15] [S114] [S152]	[S15] [S76] [S152]	[S62] [S76] [S152]		[S152]	[S15] [S84]
	Lean-Government	[S147]	[S147]	[S147]	[S147]	[S147]	[S147]	[S147]	[S147]
G3	**Agile Manufacturing**		[S28]	[S28]		[S28]			[S28]
G4	**Agile IT Governance**		[S60] [S83]	[S60] [S145]	[S60] [S83] [S145]	[S60] [S145]	[S60]	[S60] [S145]	[S60]
	Agile Projects and Portfolio Governance		[S66]		[S66]				[S66]

APPENDIX II. SLR: Emerging findings

APPENDIX II.1. Current state of Theory and Research

The statistics of publication employing each research method are listed in Table II.2. In some cases we observed that one paper (publication) brings more the one *research approach (or method)*, such as, for instance, an Exploratory Literature Review and more than one Case Study in [S8], or an Exploratory Literature Review and a Workshop in [S17], or even Expert's interviews and an Exploratory Literature Review in [S62]. Details about on which study belong to which classification are available in APPENDIX I.5.

Table II.1 – Studies by type. Source: (Luna et al., 2014b).

Study Type	Studies	%
Propositional	70	41.9%
Expert opinion	51	30.5%
Empirical	36	21.6%
Application	10	6.0%
Total	**167**	**100%**

Table II.2 – Studies by research method. Source: (Luna et al., 2014b).

Research Methods	Studies	%
Exploratory Analysis	74	44.3%
Case Study	36	21.6%
Mixed	21	12.6%
Exploratory Literature Review	15	9.0%
Survey	11	6.6%
Experience Report	4	2.4%
Workshop	4	2.4%
Factor Analysis	1	0.6%
Grounded Theory	1	0.6%
Total	**167**	**100%**

The most common methods identified were the Exploratory Analysis in 74 studies (44.3%) and Case Study with 36 studies (21.6%), followed by other methods with less representativeness. In the *mixed group* from Table II.2 were accumulated studies with more than one research method. As a matter of coherency, studies with more than one approach of the same method were not classified in this group, such as, e.g. [S63], with three case studies.

A fact that draws attention from the findings related with **research method**, if we make a separate analysis of the methods by study type, is that for both academic and industry studies

the research method adopted most often was the **Exploratory Analysis** with 49 papers (48.5%) for researchers; the others 25 papers (37.9%) using this method were carried out by practitioners. In both case, the second most often method adopted by researchers and practitioners was **Case Study** using an observational approach: 15 (14.9%) and 21 (31.8%) studies, respectively. Indeed, as advocated by Edmondson and McManus (2007), the large number of exploratory qualitative studies denotes that the studies on this area are still maturing.

Indeed, those findings denote that research design profile, when interpreted as a function of the current state of theory and research on agile governance, is evidently nascent (Edmondson and McManus, 2007). As a result, the development level demands for exploratory qualitative studies, originally open-ended data that have to be interpreted for meaning, although empirical studies can bring a more consistent and practical development for this field of study (Edmondson and McManus, 2007a).

APPENDIX II.2. Methodological quality found

Each study was assessed conforming to 13 quality criteria grounded on rigor, credibility and relevance. A resume of the questions applied to quality assessment of these studies is depicted in **Table II**.3. The detailed criteria are disclosed in APPENDIX I.3.

Table II.3 – Quality criteria. Source: (Luna et al., 2014b).

Rigor Assessment Questions
1. Is there a clear definition of the study objectives?
2. Is there a clear definition of the justifications of the study?
3. Is there a theoretical background about the topics of the study?
4. Is there a clear definition of the research question (RQ) and/or the hypothesis of the study?
5. Is there an adequate description of the context in which the research was carried out?
6. Are used and described appropriate data collection methods?
7. Is there an adequate description of the sample used and the methods for identifying and recruiting the sample?
8. Is there an adequate description of the methods used to analyze data and appropriate methods for ensuring the data analysis were grounded in the data?
Credibility Assessment Questions
9. Is provided by the study clearly answer or justification about RQ / hypothesis?
10. Is provided by the study clearly stated findings with credible results?
Relevance Assessment Questions
11. Is provided by the study a definition of Agile Governance (AG) or a definition some concept closely related with AG?
12. Is provided by the study justified conclusions?
13. Is provided by the study discussion about validity threats?

Altogether, these 13 criteria give a measure of the range to which we can be trustful that a specific study's findings can generate a relevant contribution to this review. The rating of each of the 13 criteria was performed on a scale of three values: (2) "full", (1) "partial" or (0) "absent". The quality appraisal results are detailed in APPENDIX I.6.

All 167 included studies were graded as "full" or "partial" for the first screening criterion, which presenting the definition of the aims of the study. We found 49 papers (29.3%) no had an explicit statement of the goals of the research (QA01). Just one study (0.6%) presented the topmost number of ten "absent" responses, on the quality criteria, as well as 27 studies (16.2%) presented the most often number of five "absent" responses, and only nine studies (5.4%) did not present any "absent" response. In general, this review often found that: methods were not quite explained; issues of bias, reliability, and validity were not always undertaken; and approaches of data collection and data analysis frequently were not well characterized.

In complement, each study was classified according its Quality Score, in consequence of the sum of the 13 individual quality criteria, attributed by the researchers after consensus, before the end of stage 4 (see **Figure 2.6**). Accordingly, each of the 167 studies has a Quality Score between 0 and 26 points. For these 167 papers (*n*) were applied a statistical treatment of Pareto distribution (Hosking and Wallis, 1987) for the Quality Score (QS) calculated. Specifically, the highest QS calculated (*Max*) was 22 and the lowest QS (*Min*) was 4; the total amplitude (*At*) calculated was 18, the class interval (*k*) calculated was 9 and the class amplitude (*h*) was 2. The Pareto distribution was calculated through a histogram application on the QS sample, based on the set of parameters calculated previously (*n, Max, Min, At, k, h*) and the results are depicted in **Figure II**.1.

The results denote that, only 72 studies (43.1%) have QS above the average ($QS_{average}$ = 10.7 points). Conjointly, 146 studies (87.4%) were placed into the first six frequency intervals with QS less than 16 points (intervals 1 to 6). In other words, just the 21 studies (12.6%) placed in the last four intervals of **Figure II**.1 present relative *quality significance* according the quality assessment criteria defined.

Further, each article was classified about the convergence of the study with the goals of this research, using the Likert Scale (Maurer and Pierce, 1998), during the *synthesis of findings* (stage 5), and trying answering the follow question: *"How much convergent is the study reported with the aims of this research?".* See details about in APPENDIX I.4**.**

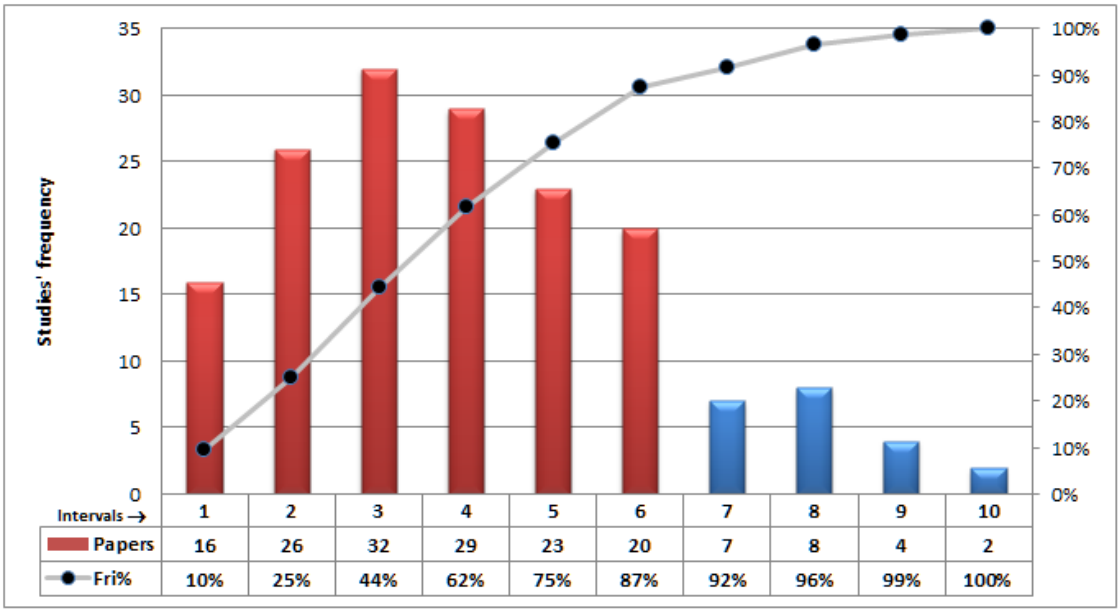

Figure II.1 – Histogram: Quality Score Pareto Distribution. Source: (Luna et al., 2014b).

As a consequence, the result from this *convergence classification* was combined with the score of the *quality* assessment generating **Figure II**.2, which highlights the status of each paper about these two classifications: quality and convergence. In a similar vein, **Figure II**.2 can be analyzed in four quadrants, which were obtained using as a reference the middle point of each scale, arbitrarily defined. The *first quadrant* (Q1) joins the best of quality and relevance, positioning 34 studies (20.4%); while the *second quadrant* (Q2) present 6 studies (3.6%) with good quality score, but with less convergence to the aims of this review. On the other hand, the *third quadrant* (Q3) has 49 studies (29.3%) with low quality scores and little convergence; therewith the *fourth quadrant* (Q4) is represented for 78 studies (46.7%) with low quality scores despite to a good convergence to the goals of this review. Appropriately, 79.4% of the studies placed in Q1 were classified as Empirical.

Regarding the initiatives, this review found a rich set of contributions applicable in agile governance paradigm, from both academy and industry concerning to consistency and relevance about how the studies were conducted. A synthesis of the contributions, focus, sampling and geography of studies placed at Q1 is depicted in APPENDIX I.7. Although we prioritized the presentation of the findings of the studies positioned at the first quadrant (Q1) from **Figure II**.2, the remaining studies corroborate with the profile identified by studies positioned in Q1, including the proportion of the findings stated in those Sections. Accordingly, during the discussion, we shall complement those results with the findings of other studies to give more contexts for conclusion, when appropriate.

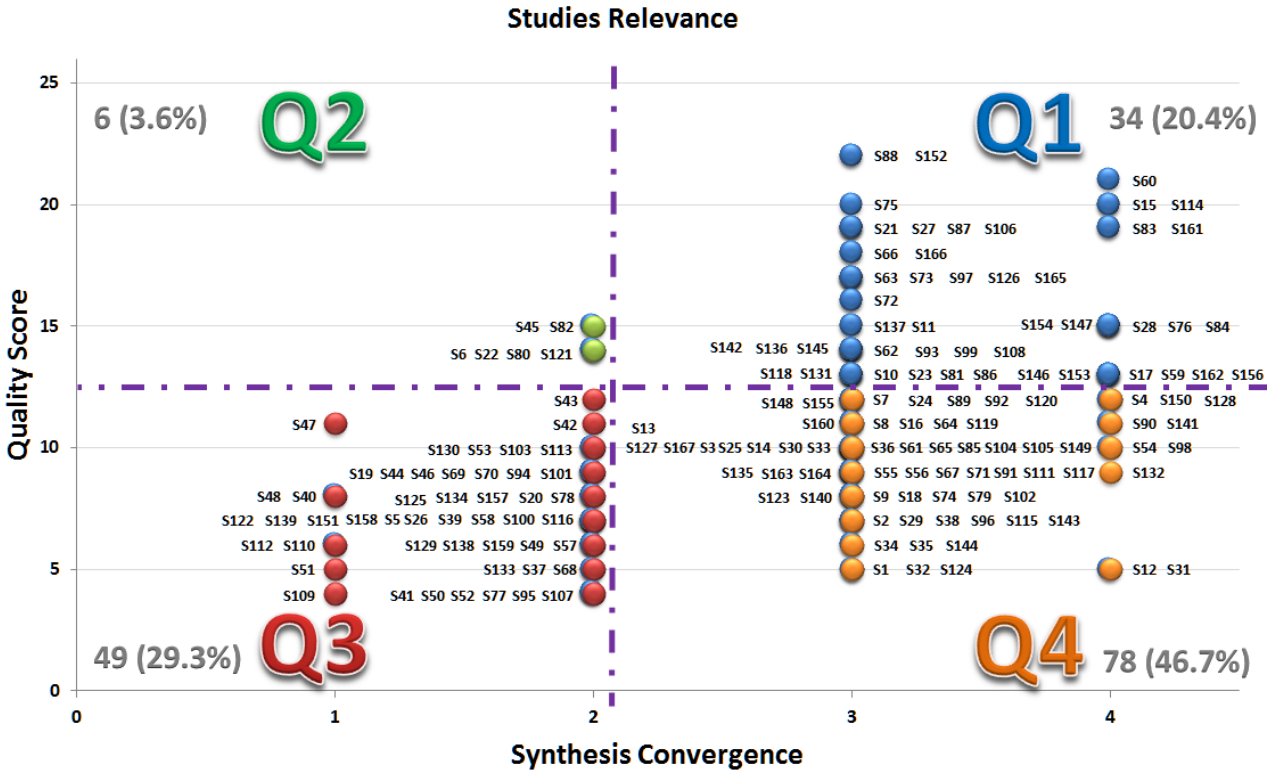

Figure II.2 – Scatter Plot: Quality Score versus Synthesis Convergence. Source: (Luna et al., 2014b).

APPENDIX II.3. Top Authors

There are many approaches to determine the contribution of authorship for scientific publications. In fact, Tscharntke et al. (2007) cite four of those authorship approaches: i) the "sequence-determines-credit" approach (SDC), where the order of authors should express the declining significance of their contribution; ii) the "equal contribution" norm (EC), in which authors use alphabetical order to acknowledge equivalent contributions or to avoid dissonance in collaborating teams; iii) the "first-last-author-emphasis" norm (FLAE), wherever the first author should receive credit of the whole impact, the last author half, and the credit of the remaining authors is the impact distributed by the quantity of all authors (which is an authorship practice well established in big labs and research groups, where the last author usually develops the role of research coordinator and is responsible for obtaining resources); and, iv) the "percent-contribution-indicated" approach (PCI), where the credit from each author's contribution is detailed in percentage.

Unfortunately, as almost totally the adopted authorship approach is not explicit in the publications, we had to arbitrate the approach selected by this research for the procedure that

follows. We applied the SDC approach for the sequence of authors and the procedures that will be described.

From the 167 papers resulting at the stage 5, we identified the following publication profile: (i) 33 studies (19.8%) of them were published by one author; (ii) 66 studies (39.5%) by two authors; (iii) 43 studies (25.8 %) by three authors; (iv) 14 (8.4%) by four authors; (v) 6 studies (3.6%) by five authors; and, (vi) 5 studies (3%) by six authors. The following procedures were conducted considering the position from first to fourth author on each paper. In other words, authors who published in position of fifth or more were not computed to answer this research question. As a matter of fact, this decision covered 346 (95.6%) from all the authors from the 167 papers, leaving out only 16 authors (4.4%) who published on fifth or sixth position. Since the goal of this research question is to identify the relevance of publication, we believe that this filter does not compromise the analysis result.

To identify the top authors, we calculated two intermediate indexes: (1) ***IndexQ***, or *quality index*; and (2) ***IndexP***, or *productivity index*. Both intermediate indexes were weighted using the smallest possible number from *Fibonacci's sequence* (Fibonacci, 2003) that allows a non-linear distribution considering the position of each author in the publications until the fourth position. Therefore, to the first author was assigned the highest weight and to the fourth author was assigned the lowest weight, according the **Equation II**.1.

$$F_n = F_{n-1} + F_{n-2}, F_0 = 0 \; and \; F_1 = 1$$
$$\therefore F_{1 \to 8} = 0, 1, 1, 2, \mathbf{3}, \mathbf{5}, \mathbf{8}, \mathbf{13} \ldots$$

$$\therefore Weight_{1(1st)} = F_8 = \mathbf{13}$$
$$\therefore Weight_{2(2nd)} = F_7 = \mathbf{8}$$
$$\therefore Weight_{3(3rd)} = F_6 = \mathbf{5}$$
$$\therefore Weight_{4(4th)} = F_5 = \mathbf{3}$$

Equation II.1. Numbers selected from Fibonacci Series. Source: (Fibonacci, 2003)

$$\boldsymbol{Index_Q} = \frac{\sum_{i=1}^{4}(\boldsymbol{Quality\ Score_i} \times \boldsymbol{Weight_i})}{\sum_{i=1}^{4} \boldsymbol{Weight_i}}$$

Equation II.2. Index of Quality. Source: Own elaboration.

$$\boldsymbol{Index_P} = \frac{\sum_{i=1}^{4}(\boldsymbol{Papers_i} \times \boldsymbol{Weight_i})}{\sum_{i=1}^{4} \boldsymbol{Weight_i}}$$

Equation II.3. Index of Productivity. Source: Own elaboration.

$$\boldsymbol{Index_R} = \boldsymbol{Index_P} \times \boldsymbol{Index_Q}$$

Equation II.4. Index of Relevance. Source: Own elaboration.

The ***IndexQ*** for each author was calculated taking into account the *Quality Score* from each paper and the author's position in it, which can be expressed by **Equation II.2**. Likewise, the ***IndexP*** for each author was calculated taking into account the number of papers found for him

or her from the final set of 167 papers selected by this review, as well as considered the author's position on each study, which can be expressed by **Equation II.3**.

Finally, we calculated the resultant index that should highlight the relevance of each author for this analysis: (3) ***IndexR***, or relevancy index, which was calculated as a function from the both intermediate indexes, conforming to **Equation II.4.**

Consequently, a ranking with 98 positions was generated, identifying 346 authors (*n*) from these 167 papers. Authors with the same *IndexR* were classified at same ranking position. After that, we applied a statistical treatment of Pareto distribution for the *IndexR* sample. As a consequence, the highest *IndexR* identified (*Max*) was 52.3670 for the first position and 0.0428 for the 98th position (*Min*); the total amplitude (*At*) calculated was 52.3242, the class interval (*k*) calculated was 10 and the class amplitude (*h*) was 6. The histogram's representation of the Pareto distribution produced from the ***IndexR*** sample, based on the set of parameters calculated previously (*n, Max, Min, At, k, h*) is depicted in **Figure II**.3.

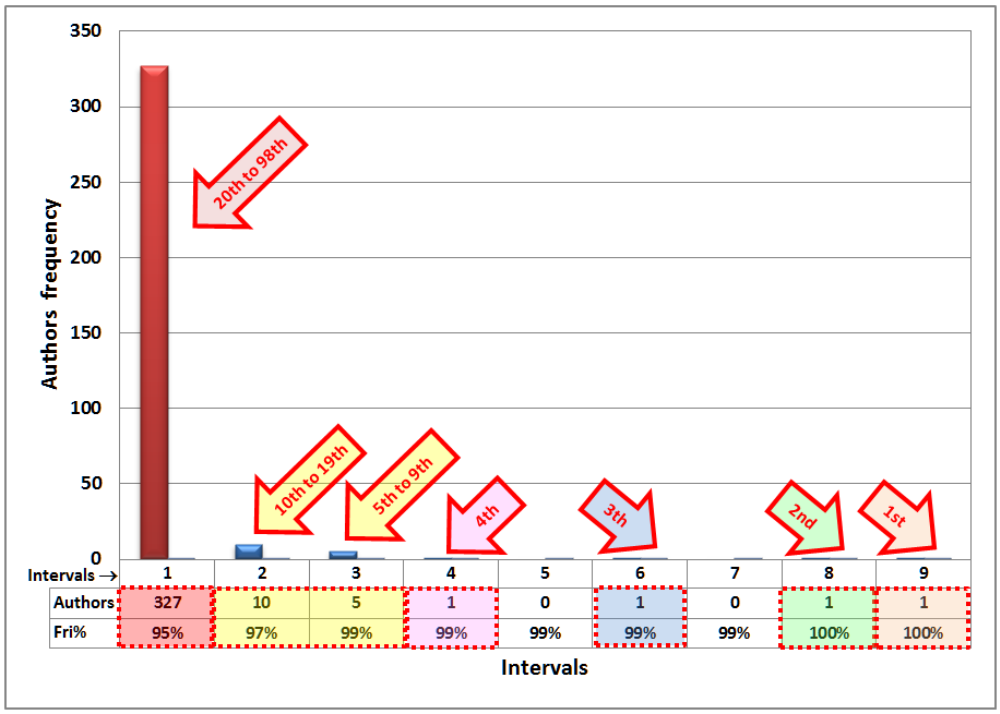

Figure II.3 – Histogram: *IndexR* Pareto Distribution. Source: (Luna et al., 2014b).

The results denote that the distance between the rank first position and the second one is described in terms of one interval, i.e., while the better ranked author is on the 9th interval, the second one appear on the 8th interval. Additionally, there is one empty interval (no authors) between the second and the third authors better ranked, as well as other empty interval between the third and the fourth ranked author. Further, we can see our five intervals only with one author in **Figure II**.3. Also, 327 authors (94.5%) from the ranking were placed into the

first frequency interval (1), representing they are in the same low level of relevancy for this review. In other words, only 19 authors (5.5%) placed in the (2, 3, 4, 6, 8 and 9) intervals present relative significance for the aims of this systematic review. Those relevant authors are depicted in **Table II**.4**.**

Table II.4 – 19 Authors placed in differentiated intervals of Figure II.3. Source: (Luna et al., 2014b).

Rank	Rank Productivity	Rank Quality	Author	Group(s): Categories	Included Review	Inaccessible List	Total Found	Quality Score (QS)	Papers as 1st	QS as 1st	Papers as 2nd	QS as 2nd	Papers as 3rd	QS as 3rd	Papers as 4th	QS as 4th
1	1	1	Dubinsky, Yael	**[G1]** Software Engineering: **[SDG]** Software Development Governance	**5**	-	5	63	4	46	1	17	-	-	-	-
2	2	2	Qumer, Asif	**[G1]** Software Engineering: **[GASD]** Governance for Agile Software Development	**4**	**1**	5	55	4	55	-	-	-	-	-	-
3	3	3	Janssen, Marijn	**[G2]** Enterprise: **[e-Gov]** e-Government	**5**	-	5	60	2	23	3	37	-	-	-	-
4	4	4	Wang, L. Xiaofeng	**[G1]** Software Engineering: **[GASD]** Governance for Agile Software Development	**3**	-	3	39	3	39	-	-	-	-	-	-
5	5	9	Kruchten, Philippe	**[G1]** Software Engineering: **[SDG]** Software Development Governance	**4**	-	4	41	1	12	3	29	-	-	-	-
6	7	8	Conboy, Kieran	**[G1]** Software Engineering: **[GASD]** Governance for Agile Software Development	**4**	-	4	53	1	14	1	17	2	22	-	-
7	8	5	Abbas, Noura	**[G1]** Software Engineering: **[GASD]** Governance for Agile Software Development	**2**	-	2	35	2	35	-	-	-	-	-	-
8	15	6	Mathiassen, Lars	**[G1]** Software Engineering: **[SDG]** Software Development Governance	**3**	**1**	4	48	1	19	1	15	1	14	-	-
9	13	7	Luna, Alexandre J. H. de O.	**[G4]** Multidisciplinary: **[ITG]** IT Governance	**2**	-	2	33	2	33	-	-	-	-	-	-
10	6	16	Ambler, Scott W.	**[G1]** Software Engineering: **[GASD]** Governance for Agile Software Development	**3**	-	3	25	2	16	1	9	-	-	-	-
11	10	11	Gong, Yiwei	**[G2]** Enterprise: **[e-Gov]** e-Government	**2**	-	2	26	2	26	-	-	-	-	-	-
12	17	10	Henderson-Sellers, Brian	**[G1]** Software Engineering: **[GASD]** Governance for Agile Software Development	**3**	**1**	4	45	-	-	3	45	-	-	-	-
13	11	13	Korhonen, Janne J.	**[G2]** Enterprise: **[EA]** Enterprise Architecture	**2**	-	2	23	2	23	-	-	-	-	-	-

Rank	Rank Productivity	Rank Quality	Author	Group(s): Categories	Included Review	Inaccessible List	Total Found	Quality Score (QS)	Papers as 1st	QS as 1st	Papers as 2nd	QS as 2nd	Papers as 3rd	QS as 3rd	Papers as 4th	QS as 4th
14	9	18	Belter, Roman	**[G1]** Software Engineering: **[SOAG]** SOA Governance	**2**	-	2	20	2	20	-	-	-	-	-	-
15	16	19	Persson, Camille	**[G2]** Enterprise: **[e-Gov]** e-Government	**2**	-	2	19	2	19	-	-	-	-	-	-
16	18	12	Baars, Henning	**[G2]** Enterprise: **[AE]** Agile Enterprise	**2**	-	2	27	1	17	1	10	-	-	-	-
17	19	15	Borgman, Hans P.	**[G4]** Multidisciplinary: **[ITG]** IT Governance	**2**	-	2	27	1	13	1	14	-	-	-	-
18	14	21	Mahnic, Viljan	**[G1]** Software Engineering: **[GASD]** Governance for Agile Software Development	**2**	-	2	17	2	17	-	-	-	-	-	-
19	20	17	Zimmer, Michael	**[G2]** Enterprise: **[AE]** Agile Enterprise	**2**	-	2	27	1	10	1	17	-	-	-	-

The statistical analysis of the **top authors** in **Figure II**.3 corroborates as evidence that publishing on agile governance is still incipient, characterizing this field as a nascent area. For this kind of analysis, we expected that the profile of **Figure II**.3 should have a symmetric distribution. If this were so, this profile would indicate that agile governance would be expressed as an area in full development, with a certain degree of maturity. Unlike, our results indicate an asymmetric distribution for **Figure II**.3, some relevant studies, few featured authors, and significant gaps between the calculated intervals.

Therefore, it is possible realize that there is a huge author population (94.5%) at the same low level of development in this domain, but they do not produce knowledge using the same patterns, perceptions or concepts (see previous Section). This situation may be result of a lack of consensus about a set of aspects that can help the academy and the industry to develop this area in a faster and better way, such as: standardization of the concepts, alignment of the vision, and structuring of the approaches, among others.

As an emerging prognosis, these results indicate that any author placed in the first interval (1) of the Pareto diagram in **Figure II**.3 (or even not classified in this study), who develops an objective work directed to this area can rapidly become relevant in this domain.

APPENDIX II.4. Top publishers

Concerning the distribution between Journals and Conference proceedings for the 167 studies was unbalanced, having a predominance of conference proceedings (62.8%) upon the journals (35.3%) and three papers (1.8%) published by Magazines.

Table II.5 – Distribution of Studies by Publication Channel. Source: (Luna et al., 2014b).

Publication channel	Type	Qty	%
Agile Conference	Conference	8	4.8%
International Conference on Software Engineering (ICSE) • *Main Track (3)* • *ICSE Workshop on Software Development Governance (5)*	Conference	8	4.8%
Hawaii International Conference on System Science (HICSS)	Conference	4	2.4%
IEEE International Conference on Global Software Engineering (ICGSE)	Conference	4	2.4%
International Conference on Theory and practice of electronic Governance (ICEGOV)	Conference	4	2.4%
BT Technology Journal	Journal	3	1.8%
Information Technology and Management	Journal	3	1.8%
European Conference on Information Systems (ECIS)	Conference	3	1.8%
International Conference on Computers & Industrial Engineering (CIE)	Conference	3	1.8%
CrossTalk - The Journal of Defense Software Engineering	Journal	2	1.2%
Government Information Quarterly	Journal	2	1.2%
International Journal of Business Information Systems (IJBIS)	Journal	2	1.2%
Journal of Business Research	Journal	2	1.2%
Journal of Systems and Software	Journal	2	1.2%
IEEE International Conference on Industrial Engineering and Engineering Management (IEEM)	Conference	2	1.2%
IEEE International Engineering Management Conference	Conference	2	1.2%
IEEE World Congress on Services (SERVICES)	Conference	2	1.2%
IET International Conference on Agile Manufacturing	Conference	2	1.2%
International Conference on Communications and Information Technology	Conference	2	1.2%
International Conference on Management Science & Engineering (ICMSE)	Conference	2	1.2%
International Group for Lean Construction Conference (IGLC)	Conference	2	1.2%
Other Conferences with just one paper contribution	*Conference*	*57*	*34.1%*
Other Journals with just one paper contribution	*Journal*	*43*	*25.7%*
Other Magazines with just one paper contribution	Magazine	*3*	*1.8%*
	Total	**167**	**100%**

Table II.5 depicts the publication channels with more than one paper found in this review. We can see both *Agile Conference* and *International Conference on Software Engineering (ICSE)* have the largest number of *eight studies*. In the case of ICSE, including three publications in the

main track of the conference, as well as five publications specifically in the ICSE *Workshop on Software Development Governance*. At the same time, the *BT Technology Journal* and the *Information Technology and Management Journal* have the largest number of *three studies* among the journals. As a matter of pragmatism, other 57 conferences and 43 journals that contributed to this review *with just one paper* were, each one, grouped in just one line on the **Table II**.5.

APPENDIX II.5. Shortcomings

From the 34 studies at Q1, we found 52 references extracted from Quotes related to shortcomings of application of agile capabilities on governance issues. These references were classified in six types: i) **deficiency** or aspects that need to be improved (50%); ii) neglected **topics** of study (16.7%); iii) **weaknesses** or aspects that might generate vulnerability (14.6%); iv) **shortages** or aspects that denote the absence of something (8.3%); v) **conflicts** or aspects that can come into collision or disagreement; be contradictory, at variance, or in opposition (8.3%); and, vi) **difficulties** or aspect that can be faced as a barrier or **limitation** to be overcome (2.1%). Eventually, some references were classified in more than one type, such as stated by Roberts and Grover (2012) [S152], below, which was classified as a *deficiency* and, also as a *needed or worthwhile topic of study topic of study*:

> *"As a result, we lack deeper understanding of how certain aspects of IT infrastructure impact sensing and responding capabilities in particular."*

In complement, the shortcomings were classified according its core aspect, and posteriorly grouped. The result of this approach is depicted in **Table II**.6.

Table II.6 – Shortcomings classification (Q1). Source: (Luna et al., 2014b).

Shortcoming	Qty	%	Studies
Model inadequacy	16	30.8%	[S28], [S60], [S62], [S75], [S76], [S99], [S108]
Communication inadequacy	7	13.5%	[S11], [S66], [S72], [S99]
Needed or worthwhile topic of study	6	11.5%	[S15], [S75], [S87], [S152], [S154], [S166]
Concept misinterpretation	5	9.6%	[S84], [S142], [S147], [S152], [S166]
Rigidity	4	7.7%	[S28], [S84], [S106]
Culture	4	7.7%	[S11], [S72], [S99]
Alignment inadequacy	4	7.7%	[S66], [S83], [S99]
Tool inadequacy	3	5.8%	[S75], [S87], [S136]
Metrics inadequacy	3	5.8%	[S21], [S126], [S166]
Total	**52**	**100%**	

For instance, we found 16 mentions related with aspects associated with limitations in **models, frameworks or methods**, encompassing: *lack of agile approach* [S28], [S60], [S75], [S76], [S108]; problem of communication due *lack of appreciation of people in governance processes* [S11], [S72], [S99]; *role conflict* [S99]; and *lack of alignment to business* [S62], [S99]; *lack of practical approach* [S28]; *lack of wide approach* [S62]; and *bureaucracy* [S62].

At the same time, we identified seven shortcomings associated with **communication**, such as: caused by the *lack of appreciation of people in governance processes* [S11], [S72], [S99]; *lack of feedback loop* [S66], [S99]; due to *customer unavailability* [S97]; and *lack of communication between product owners and teams* [S99]. Moreover, we found six topics pointed out as **neglected issues of study** or wide open topics with very few publications, covering: *agile governance* [S75]; *e-business strategy* [S87]; *enterprise agility* [S166]; *IT capabilities* [S152]; *IT governance architecture* [S15]; and *the need to understand the impacts of implementing multiple process approaches in enterprise* [S154].

We found five references related to misunderstanding or ambiguity related with the use of the **concepts**. Also, we found four aspects related with the **rigidity** or lack of flexibility, such as: lack of business agility as a threat in volatile markets [S106]; the *contradiction between stability of business models and enterprise rigidity* as a risk [S84]; *IT rigidity as the reason behind a lack of agility* or weakness of agility [S106]; the *lack of manufacturing agility* as a risk to failures at business level [S28].

Four references pointed out aspects linked to **culture**, such as: *lack of cultural sensitivity as fragility* in collaborative relationships [S72]; the people's engagement as a consequence of a lack of appreciation of them in governance processes [S11], [S72], [S99]. Other four references were identified with aspects that depend on the **alignment** and coordination of the whole enterprise, such as: *lack of business theme prioritization* [S66], [S99]; *lack of managerial support* [S83]; and, the *lack of congruence between the internal process performance and improvement in customer service*, as a risk, reducing of the firm's capacity and productivity [S83]. Three references were connected with shortcomings to the planning and arrangement of **tools** for a particular aim, such as: *confidentiality related to e-business and strategy* [S87]; *lack of agility attributes on SOA* [S75]; or even the *lack of tools to support retrospective practices* [S136].

Finally, other three references were aspects related with limitations of **metrics** and/ or indicators, such as: the need for develop *comprehensive metrics to measure enterprise agility*

considering to its multidimensionality and ambiguity concepts [S166]; the *need for BI agility metrics* [S126]; the existence of few empirical studies that attempted to *measure operational agility in an empirical setting* [S21].

In synthesis, this review collected a set of shortcomings pointed out by the authors from the 167 papers selected. After that, we carried out the organization and filtering of these information. Properly, parts of them were related with technical aspects or a specific category. As a matter of prioritization this Section will discuss only the shortcomings related with broad vision about agile governance paradigm, trying to avoid discussions on technical or too specific issues.

In retrospect, several authors [S11], [S28], [S60], [S72], [S75], [S76], [S108] pointed out the *lack of methods, techniques and tools to help people and enterprises to achieve the business go*als, by means of the governance issues, in an agile way independent from the business area. At the same time, many authors [S5], [S28], [S60], [S62], [S90], [S96], [S99], [S150] claim that the governance practices, models, guides and frameworks are *most of them bureaucratic, time consumer and having no guidance details of how to implement and deploy the necessary management instruments and governance mechanism*, such as ITIL (Mendel, 2004), COBIT (Gerke and Ridley, 2009), among others.

In addition, some evidences found point out the *problem of communication and people engagement as a consequence of a lack of appreciation of people in governance processes*, can be considered a relevant *critical factor of success* in governance case studies [S11], [S14], [S18], [S40], [S66], [S72], [S97], [S99], [S110]. At the same time, some topics were pointed out as *neglected areas of study or wide open fields with very few publications*.

APPENDIX II.6. Trends

Based on the studies positioned at the first quadrant (Q1) we found 22 references that pointed out some kind of trend about the phenomena in study. We organize the trends in the following categories: i) related with a new way or **approach** to develop or do something (45.5%); ii) having connection with an **adoption** or selection of a new emerging standard to be combined with a well-established one, generating a new one integral whole (36.4%); and, iii) related with an **emerging topic** of study (18.2%). The studies which fit in each classification are depicted in **Table II**.7.

Table II.7 – Trend classification (Q1). Source: (Luna et al., 2014b).

Trend	Qty	%	Studies
Emerging approach	10	45.5%	[S15], [S21], [S66], [S72], [S87], [S93], [S97], [S147], [S152], [S166]
Emerging adoption	8	36.4%	[S27], [S60], [S72], [S73], [S76], [S83], [S145], [S152]
Emerging topic of study	4	18.2%	[S21], [S93], [S126], [S166]
Total	**22**	**100%**	

We can cite as **emerging approaches**: the even more often application of agile and lean approaches in Distributed Software Development (DSD) projects, given an idea of *agile DSD* [S72]; the application of *agile approach for process improvement* reflecting positively in customer service and firm performance [S97]; a more comprehensive operationalization of *business agility* broadening the theoretical and practical implications regarding its different dimensions, like market, network, and operational agility [S21]; the tendency in which a firm is able to *sense and respond quickly* to customer-based opportunities for innovation and competitive action, under the concept of *customer agility* [S152]; *enterprise agility* as an important trend approach for contemporary firms in today's dynamic business environment [S166]; *flexible strategy* as a required approach to face unpredictability and turbulence of the business environment, for instance in e-business strategy [S87]; the philosophy of *"doing more with less*" as a trend approach in public sector [S147], as well as the *New Public Management (NPM)* as a tendency in lean government [S93]; the *modular IT architectures* as a trend by facilitating agility in organizational IT activities [S15]; and, the *reflective practitioner* as a desired behavior for teamwork to face governance issues in a participative way [S66].

Moreover, as **emerging adoptions** we can mention: the application of *agile capabilities on business issues* [S27], [S60], [S76], [S152]; adoption of *cloud computing* as an enabler of IT infrastructure flexibility and agility [S145]; the application of *governance practices* for agile software development [S73]; the growing adoption of *agile methods on DSD projects* [S72]; and the *improvement in process level* as an enabler of improvement in customer service and firm performance [S83].

In addition, as **emerging topics of study** (iii), we can quote: *architectural agility* [S126]; *business agility* [S21]; *enterprise agility* [S166]; and *lean government* [S147]. Further inference about the results of this Section will be discussed in Section 3.7.10. Details about the relationship between the studies, constructs and the emerging categories are available on the APPENDIX I.8.

As a matter of coherence, now we will try synthesize this matter discussing only **trends** related with broad outlook of agile governance paradigm. Chulani, Williams and Yaeli (2008) [S1]

suggest as a trend the application of **Software Development Governance (SDG)** to achieve productive software development environment. Whiles, Dubinsky and Kruchten (2009) [S71] cite a set of workshop's technical goals, which can be considered as **SDG trends of investigation**, such as: (1) "*Investigate the relationship between governance models and software development environments and processes*"; e.g., the project or program management processes; (2) "*Examine the lifecycle of software development governance and how it relates to the software engineering lifecycle*"; and (3) "*Explore and evaluate existing implementations of software development governance*".

In addition, we detect as **architectural approach trends**: *Business Process Management (BPM) and Service Oriented Architecture (SOA) convergence* [S13], [S41], [S46], [S59], [S142], [S157], *SOA Governance for service governance structure* [S82], [S130], [S143], [S144], [S57], [S164], [S143], *modular IT architecture using SOA* [S15], *Service-oriented Computing (SOC)* [S105], [S104], and *SOA approach on Enterprise Architecture (EA)* [S98].

Also, we found out as emerging trends *for worthwhile topics of study related to* **enterprise approach**: *business agility* [S17], [S60], [S106], *agile organizations* [S17], [S31], [S38], [S120], *agile finance* [S17], [S106], *agile contracting* [S17], [S117], *agile people management issues* [S17], [S27], [S60], and the *implications on society of the agile movement* [S17], [S106].

On the other hand, we identified some *trends related with* **Governance for Agile Software Development (GASD)**, regarding to: *Economic Governance* as an approach focused on sustainable business-related perspective for agile projects [S132], [S163], as well as *Disciplined Agile Delivery (DAD)* as a scalable process decision framework to software delivery [S122], [S132].

On **public administration**, we meet with the following trends: *Collaborative Networked Organizations (CNO)* for pro-active public services [S18], *application of lean techniques in public services* for back office clerical work [S93], *reforming the public sector* by the aspirations of citizens, who are placing new demands on governments [S45], *smart cities* to provide a shared infrastructure for automated services to improve the life of their citizens [S25], [S65], [S67].

In fact, in recent years, we have been found consistent evidences of the fast growing of publications related with the **application of agile and lean capabilities on public sector**, such as: management model for Portuguese public administration [S45], *lean innovative*

"managerialist" response to UK government demands [S93], UK *lean policing* [S128], Dutch *lean government* and platform-based governance [S147], the evolution for an *agile process of contracts*, procurement and *supply chain*, of the equipment primarily to the U.S. military services [S148], *agile policy development* for digital government in four U.S. federal agencies [S153], European *participatory urban planning* [S156], lean UK government approach for *customer service* [S162].

Some **technologies** and approaches also has been considered *as enablers* for application of dynamic capabilities on governance issues as advocated by the several studies.

When we look to the set of specific trends highlighted in this Section separately, we can be led to do not realize the connexions existing among them, due they have different levels of abstraction, dimensions, categories and focus. Albeit, when we analyze their components systematically, as part of the same phenomena, we can understanding and translating their resultants in some ***overall trend movements*** that can help to describe the phenomenon under study itself. We will discuss these *trend movements* in Section 3.7.10.

APPENDIX II.7. Who uses it?

Based on findings of the review, we elaborate the **Table II.8** as a sample of application (use) of agile governance, by scholars and practitioners, to illustrate the occurrences of its phenomena in different circumstances, in a globalized context.

Table II.8 – Agile governance application: a sample. Source: (Luna et al., 2014b).

Category	Trend or approach	What for?	Who?
Agile Public Administration	**Participatory decision making process**	Italian participated urban planning to provide sustainable development scenarios for territory planning [S156] (Monizza et al., 2013)	**European** community
Agile Public Administration	**Agile public administration & virtual organizations**	Pro-active public services [S18] (Cellary & Picard, 2010).	The co-organization of the 2012 UEFA European Football Championship by **Poland** and **Ukraine**.
Agile Public	**Application of**	Enhancing the effectiveness of the back	British civil service, **UK**.

Category	Trend or approach	What for?	Who?
Administration	**lean techniques in public services**	office clerical work [S93] (Carter et al, 2011).	
Agile Public Administration	**Lean policing (adoption of a 'Lean' philosophy)**	In response to the government's call for reform and to address the challenges of a decrease in future police funding [S128] (Barton, 2013)	**UK** police service (5 Case studies)
Agile Public Administration	**Lean government approach**	To improve internal efficiency of customer service [S162] (Radnor & Johnston, 2013)	2 case studies of large **UK** Government departments
Agile Public Administration	**An agile process of contracts, procurement and supply chain**	To supply equipment primarily to the U.S. military services [S148] (Knaggs, Pollard & Wang, 2012)	**U.S.** Supply Services (USSS)
Agile Public Administration	**agile policy development**	Accelerating the policy development process for digital government in four U.S. federal agencies [S153] (Parcell & Holden, 2013)	4 **U.S.** federal agencies
Agile Enterprise	**Information Systems Governance, Agility and Strategic Flexibility**	Contributions and problems resulting from simultaneous implementation of several process approaches [S154] (Makhlouf, 2012)	Telecom & Management Sud Paris, very large Telecommunication Operator in **France**
Agile Enterprise	**Lean enterprise**	Application of lean principles to BT, and describes some of the lean tools and techniques that are being used to transform BT [S117] (Jones et al., 1999)	British Telecom, **UK**
Enterprise Architecture	**Governance for systems architecture**	The only solution is to restructure how the company undertakes its complete operational support function — a journey which has to start with an architecture [S116] (Strang, 2005)	British Telecom, **UK**
Enterprise	**Agile company**	To provide flexibility and adaptability of	HP, **US**

Category	Trend or approach	What for?	Who?
Architecture	**and adaptive enterprise**	information technology (IT) [S115] (Wilkinson, 2006)	
e-Government	**Approach to measure the process flexibility and agility in an e-government context**	To improve their systems and architectures, applying agility and flexibility in their business processes [S4] (Gong & Janssen, 2010)	The Dutch Immigration and Naturalization Service, The **Netherlands**
e-Government	**Flexible and agile policy implementation**	To improve this, policy makers and policy executors are searching for ways to achieve higher levels of flexibility and agility in their business process management systems [S142] (Gong & Janssen, 2012)	Dutch Tax and Customs Administration (DTCA), The **Netherlands**
e-Government	**Shared services implementation in public administration (e-government)**	Reforming the public sector by the aspirations of citizens [S45] (Domingues & Gomes, 2011)	Central Public Administration, **Portugal**
Lean Governance	**Lean governance**	Force multiplier for achieving the outsourcing objectives of both business and IT dimensions [S58] (Kancharla, 2007)	Tata Motors, **India**
Service Governance	**Agile and lean deployment for SaaS**	To enhance the efficiency and accuracy of software delivery [S57] (Benefield, 2009)	British Telecom, **UK**
Agile IT Governance	**Governance for Cloud Computing**	Improved agility, expanded business networks, and enhanced decision-making [S131] (Borgman et al., 2013)	Accenture, **France**
Agile IT Governance	**Cross enterprise collaboration in multi-sourcing IT services**	Conversation-oriented, flexible and policy-aware process collaboration among people from different enterprises [S159] (Nezhad et al., 2012)	Hewlett Packard Laboratories, Palo Alto, **US**

Category	Trend or approach	What for?	Who?
Governance for Agile Software Development	**Agile software governance transformation**	Improving software governance practices doing insourcing with consultants and recruiting at the same time as building agile practices [S151] (Schantz, 2013)	Case study in a Financial group Cochito Oy, **Finland**
Software Development Governance	**Multisite governance model for Global Software Development**	To analyze their multi-site governance activities adopted and adjusted based on the Scrum methodology [S160] (Noordeloos et al., 2012)	In a consultancy firm located in The **Netherlands**, together with an offshore site in India, and the client is a finance firm
Software Development Governance	**Governance of agile software teams**	Becoming more effective the governance of agile software teams for large-scale projects [S73] (Talby & Dubinsky, 2009)	Israeli Air Force , **Israel**

APPENDIX II.8. Strength of evidence

There are several options to develop an assessment concerning to the strength of evidences in (Atkins et al., 2004). In keeping with Kitchenham et al. (2007), some of them propose that the strength of evidence can be established on a hierarchy where concreteness from randomized experiments and systematic reviews at the apex of this hierarchy and evidence from expert opinion and observational studies at the base of this hierarchy. Notwithstanding, setting up this kind of experiments sometimes demands a high time consumer or are not feasible in specific contexts. In these cases the application of observational studies can be a good alternative to produce better evidence.

Using an approach similar to Dybå and Dingsøyr (2008), we adopted the GRADE working group definitions to assess the entire strength of our review's evidences (Atkins et al., 2004). As stated in GRADE, the strength of evidence can be defined through the consolidation of four keystones, such as: (1) to study **design**, (2) study **quality**, (3) **consistency**, and (4) **directness**. These key elements are assessed in four level of grading: (a) **High**: Further research is quite improbable to change the reliability in the estimation of effect; (b) **Moderate**: Additional research is probable to have an relevant impact on the confidence in the estimation of effect and might modify the estimation; (c) **Low**: Further research is quite probable to have an relevant impact on the reliability in the estimation of effect and is probable to modify the estimation; and, (d) **Very**

low: Any estimation of effect is very unreliable. The GRADE system categorizes evidences establish on study design, assigning a high grade for randomized experiments and low grade for observational studies. Nevertheless, by the evaluation of the other key elements mentioned, the initiatory overall assess could be revised and amended, according the identification of inconsistences or high-quality observational inquiries, for instance.

In relation to **study design,** were identified only eight studies where the authors argue that they have developed some kind of experiment, while the remnants primary studies were observational. In two of them [S6], [S78], were not found evidence described in the paper about the experimental procedure. Only in two of them [S15], [S152], was described explicitly that the experiment was carried out randomly. *The fact of there are few experiments would be expected because the maturity level identified by this review for this domain*. Indeed, this fact is coherent with the argument of Shadish et al. (2002) that experiments are best applied to examine specific cause-effect phenomena. As a matter of fact, the initial classification of the overall evidence in this review grounded on **study design** is **low**. Now, we will address the other *key elements* of the studies, in the evidence base.

Regarding to the **quality** of the studies, truly methods were not well characterized, in general; issues of validity, bias, and confidence were not always undertaken; and approaches of data collection and data analysis frequently were not well reported. Moreover, 64 studies (38.3%) did not describe the research *method adopted to carry out the research* (QA05), as well as only 23 studies (13.8%) presented the details, evidences and references adequately. Similarly, 102 studies (61.1%) did not describe the *data collection procedures* (QA06), whilst just nine studies (5.4%) explained these procedures in a clear way. Further, 99 studies (59.3%) did not *characterize the sample* used by the research or the *methods applied for identifying and recruiting the sample* (QA07), at the same time, just 12 studies (7.2%) clearly defined the subjects or research cases. Conjointly, 110 studies (65.9%) did not report the *methods used to analyze data* or whether appropriate methods for certify that the data analysis were grounded in the data (QA08), equally only 12 studies (7.2%) clearly defined how the data were analyzed. Eventually, 127 studies (76%) did not provide any discussion about *validity threats*, 32 studies (19.2%) discussed the validity threats during the study (QA13), and only eight studies (4.8%) discussed the threats to the validity in a specific Section. In other words, according the Pareto distribution (Hosking and Wallis, 1987) from **Figure II**.1, just the 21 studies (12.6%) placed in the last four intervals present good quality significance according the quality assessment criteria

defined. Based on these findings, we imply that there are **severe restraints to the quality of the studies** that unavoidably increases the risk of bias or misconception. Hence, we must be cautious about the studies' confidence.

Concerning to **consistency**[78] of the studies, were not found significant differences of alignment among them. In spite of studies present some concepts described in different way, or use some different words to describe same concepts, this situation represent, in our opinion, the **idea of incompleteness, but not the idea of inconsistency**. Eventually, we found some studies proposing apparently conflicting point of view, such as [S69] *about the supposed tendency to adopt lean to the detriment of agile approaches*, when compared with the point of view of the remaining studies. Even so, in this case, when we go deeper, the differences were no significant. Still, the same authors in a subsequent study [S165] reassessed their point of view proposing a convergent alignment among lean and agile approach, conform the point of view of this review. Nevertheless, this kind of occurrence happened in really few cases, with no considerable threats to validity. These inconsistencies may be due to inaccurate or sparse data, and describing bias.

In relation to **directness**[79], we classified each paper about the convergence of the study with the aims of this research, during the Synthesis of findings (stage 5 from **Figure 2.6**). As a result, 26 studies (15.6%) presented strong convergence, 86 studies (51.5%) presented convergence, 48 studies (28.7%) presented weak convergence, and just seven studies (4.2%) presented very weak convergence. In fact, this review found 112 studies (67.1%) with significant convergence to its aims. On another hand, when we analyze the studies from the point of view of the area of specialization, we should do that under the lens of the data of **Table 3.2** and **Figure 3.7**. Our review identified 16 categories organized in four major groups, and there are significant intersections between these major groups. In general, there are enough consistence and coherence between the studies selected by this review, but they present a fragmented view about the domain of agile governance. Our point of view is thus that **there is no significant incertitude about the directness** of the selected studies.

Analyzing these four components of study, we identified that the *strength of the evidence* in the present review concerning to the state of art of agile governance is **low**. Thence, any estimation of effect that is grounded on evidence of agile governance from current research

78 "The similarity of estimates of effect across studies." (Dybå and Dingsøyr, 2008b)
79 "The extent to which the people, interventions, and outcome measures are similar to those of interest." (Dybå and Dingsøyr, 2008b)

has low certainty. This evaluation is consistent with the nature of a nascent field and with the fact of this review be pioneer in an unexplored area, quite lacking of studies. At the same time, this review is a positive step, maybe the first one, on toward to shed some light about the *complexity*[80] of this domain.

APPENDIX II.9. Implications for research and practice

Several inferences for research and practice can be derived from our systematic review. For **research**, this review demonstrates a clear necessity for studies with more scientific rigor, according the quality assessment reported in APPENDIX II.2. Our review found only 36 studies (21.6%) that were empirically conducted, which indicates a need for further empirical studies.

Table II.1 and **Table II**.2 depict a variety of research methods that have been practiced in different types of study approach. Truly, new researches need to apply both fixed and flexible research designs if they are to reach a deeper comprehension of agile governance.

At the same time, Edmondson and McManus (2007) advocate that the research design has to adapt itself to the current state of theory and research. Actually, they arrange this state into three types: *nascent*, *intermediate*, and *mature*. According to this classification, for agile governance, we believe the present state of theory and research on methods is evidently *nascent*, which implies a demand for exploratory qualitative studies, originally open-ended data that have to be construed for meaning: what matches with the evidence profile found by this review (see Section 3.7.10). Our review confirms that agile governance has a wide spectrum of interest for executives from any business area, professionals, researchers and practitioners by treating, in essence, aspects such as: organizational performance and competitiveness, as well as it can be verified by the categories and major groups that emerged from these research findings (see Section 3.7.6).

As discussed in Section 3.7.9, the evidences found lead us to realize the **urgent need for development of ontology for the agile governance paradigm** (Gruber, 1993), as well as the entire set of knowledge identified should be organized, connected and systematized in some kind of *conceptual framework* or *theory* (Bordage, 2009). Moreover, the **shortcomings** and **trends** identified in APPENDIX II.6, point out some direction for this domain research. Likewise,

80 In other words, *subjectivity* and *multidisciplinary*.

the results discussed in APPENDIX II.3 suggest that **any author who develops an objective work directed to this area he or she can become relevant rapidly**.

We believe that *researchers* and *practitioners* in agile governance should cooperate to define a common research agenda, for the sake of enlarge the usefulness and suitability of the research **for industry** and to produce an enough quantity of studies of great quality on subtopics associated to this field. We recognize that is outside the sphere of this paper propose such agenda, but we expect that the synthesis of research conferred herein may give the inspiration to conceive one.

This review presents, for **practitioners**, that several auspicious studies of the use of agile governance have been related (66 studies, 39.5%), most part of them were case studies (21 studies, 12.6%) and exploratory analysis (25 studies, 15%) in industry. In spite of industry have had good number of **empirical studies** (20 studies, 12%), serious restraints have been noticed in the remaining set of studies. For instance, 21 industry studies, were classified as **expert opinion**, i.e., when the study in question presented "lessons learned" report, minimally grounded, based on expert opinion, without presenting the minimal scientific rigor to be classified as empirical. Despite this, from 34 studies positioned in the first quadrant (Q1) of **Figure II**.2, 18 of them are from industry. This denotes that industry have had a balanced quality production in this domain with relevance to this review.

Another aspect to be highlighted is that, while we found 38 studies (22.8%) in the Enterprise group (G2) from academic studies (see Section 3.7.6), we found just 22 studies (13.2%) in the same group as industry contribution. This comparison denotes the **need for more studies in industry about application of agile capabilities upon governance issues on Business Management and Public Administration**, and its focus on the enterprise as a whole. Strictly, the major part of the studies found in industry is concentrated in Software Engineering major group (G1), with 28 studies (16.8%).

Other strongest evidence for practice is suggesting that it is needful to focus in the *development of governance practices, models, guides and frameworks with practical approach and less bureaucracy* [S20], [S86], [S96], [S113], [S154]. Analogously, the problem of communication and people engagement as a result of a *lack of appreciation of people in governance processes*, can be considered a relevant *critical factor of success* in governance case studies [S11], [S14], [S72], [S99], [S110], [S136].

Furthermore, companies and practitioners should use the findings of this review with critically discernment, in order to identify resemblance and discrepancy between the studies presented and their own reality. A distinct and important support in this appreciation is the characterization of the context of the studies in this review (APPENDIX I.5, and APPENDIX I.7).

Likewise, we invite enterprises to engage in research projects in the future, with the view to address research aims that are significant for the industry. Truly, action research is a contributive and convergent way of systematize cooperation between researchers and industry that would be immensely positive for a flourishing field such as agile governance. In retrospect, these findings represent a great opportunity for new research and practice on this domain. At the same time, they might represent an obstacle to be overcome for a most significant advance in the production of this field, for industry and academy.

APPENDIX II.10. Limitations of the review

Usually, the major limitations of a review are biases in the *publications selection* and *imprecision in data extraction procedures* (Kitchenham et al., 2007). In furtherance, to aid to assure that our selection process was unbiased, we elaborated a research protocol beforehand that delimited the research questions. Applying these questions as reference, keywords were identified and search terms, which would allow us to recognize the appropriate literature, were developed and tested.

We do recognize that the keywords, generally, are not patterned, much less in a multidisciplinary context such as agile governance. Besides, the subtlety of its application can be consequence from both knowledge domain and language specificity. Accordingly, by cause of our decision about the search strings and keywords, as well as the syntax of the search mechanism from each electronic database, there is a chance that pertinent studies were omitted.

Toward to minimize selection bias, every stage of the review process had a pilot practice. Special attention was given to the search strategy along with citation management procedure (stage 1 from **Figure 2.6**), in favor of clarify vulnerabilities and refine the selection procedure. Strictly, to further insure the impartial selection of studies, a multistage process was applied. Furthermore, this process (depicted in **Figure 2.6**) involved two researchers (or “pair”) at the stages 1 to 4 who recorded the justifications for inclusion/exclusion at each step, as detailed in

review protocol (Luna et al., 2014c), also available at APPENDIX I, and as suggested by Kitchenham et al. (2007). Indeed, none study was excluded without a consensus in the pair's analysis. Even in relation to the low Kappa coefficient in the initial stages of this review (see **Table I.3**), the authors believe that it does not impact on the credibility of the decisions (inclusion or exclusion) because, whenever the researchers do not reached a consensus, the paper was included for next stage.

Other limitation to consider is the fact of this review has an "*inaccessible list*" of 26 papers that *apparently*, have some relevance for this research, but could not be assessed to confirm this supposition. Meanwhile, this number of papers can be considered low (2%) if we consider the amount of 1272 input papers of the stage 3. In other words, this aspect can be considered part of the consistency of the strength of evidence found by this review, that despite being an aspect that cannot be ignored, it does not mischaracterize the representativeness the final findings.

All along the pilot of the data extraction procedure (stage 4), we found that various papers lacked enough details about the study design and related findings. Therefore, in the beginning, we diverged too much in what indeed we extracted. Directed toward reduce the bias, the data from the entire set of studies at this stage were extracted by two researchers separately (on each pair), conforming to the predetermined extraction form (APPENDIX I.4), and this information were gathered in a database through the tool developed during this review. After that, the researchers from each pair carried out a set of meetings to select the *final extracted data* by consensus, using another interface of the same tool. Moreover, we realized that the extraction process was constantly hampered by the manner some studies were disclosed. Lamentably, sometimes the documentation procedure cannot be satisfactorily carried out using the extraction form, due several studies lacked sufficient information to do that. Hence, there is a chance that the extraction procedure might have conducted to some imprecision in the data. Anyhow, we believe that because the methodological rigor followed by this review, the universe set of studies obtained, is at least, *representative sampling from the phenomenon under study*.

In spite of some scholars can argue that the authorship approach adopted by the procedures of the APPENDIX II.3 might represent some biases, because some research groups adopt a different approach to describe the sequence of the names of the authors during the

publication, where traditionally, the first author contributes most and also gets most of the credit, while the position of ensuing authors is frequently decided by: (i) contribution, (ii) alphabetical order, or (iii) reverse seniority (Tscharntke et al., 2007). Although, our approach has considered only the credit by contribution, we would like to clarify that: (1) we adopted a well-established approach to analyze the authorship contribution (Hunt, 1991; Verhagen et al., 2003); (2) the objective of this approach is not publish authors' ranking, but try to shed a light about how is the publication profile for this area, how many authors are excelling in this area, and how those information can contribute with the other findings to understand the state of art of agile governance.

APPENDIX II.11. Review conclusions

This review brings the following three main contributions: (1) advance in the state of art of agile governance, providing a mapping of findings organized in four major groups and 16 categories, which can be figured by relevance and convergence; (2) a new and convergent definition for agile governance, six meta-principles, four meta-values, the concept of a dynamic repository for the knowledge related to governance topic (GBOK) and some directions for research and practice; and, (3) a scientific approach that can help researchers and practitioners to advance methodology for combining diverse study types, as well qualitative research, in systematic reviews of business agility interventions.

Our systematic review identified 1992 studies in the literature, of which 167 were recognized to be research studies with plausible: rigor, credibility, and relevance. Among them, 159 (95.2%) were primary studies, as long as eight (4.8%) were secondary studies.

Suitably, the studies were matched into four major thematic groups: (G1) Software Engineering; (G2) Enterprise; (G3) Manufacturing; and, (G4) Holistic (or Multidisciplinary); we also classified them into 16 categories. Our review identified a number of evidences related with the state of art of agile governance organized in a set of constructs, according to each research question.

Accordingly, the GBOK concept should be refined and must have its scope and boundaries better defined in future works. In fact, the whole evidence related to trends and shortcomings found by this review given in 0 (to say the least) should be faced as backlog for future works in this paradigm.

Howbeit, the strength of evidence is low, which suggests that we should be cautious in offering specific recommendation to industry and academy. In consequence, we advise lectors to use this paper as kind of roadmap of topics, which they can employ to investigate further relevant studies and correlate the settings in the studies conforming to their own circumstances.

An evident finding of the review is that agile governance is a nascent, wide and multidisciplinary domain, focused on organizational performance and competitiveness that needs to be more intensively studied and might have its boundaries better defined. The body of knowledge in this domain should be organized, connected and systematized in order to help people and enterprises to achieve the business goals. At the same time, the evidences found by this review highlight the necessity to stimulate both the quantity and, specially, the quality of studies on agile governance. Absolutely, we can realize that there is a research backlog with topics that need to be tackled. Naturally, researchers and practitioners should work together to define a reciprocal research agenda for new research and practice on this domain, as well as to get closer to the wide spectrum of interest and application identified by this review.

As an additional result, we improved and complemented the methodological approach on which was based this review (see APPENDIX I): (i) upgrading and adding new procedures to carry out a systematic review; (ii) as well as developing a tool to support this research in a geographically distributed manner; and, (iii) adopting quantitative procedures to develop a qualitative analysis of the evidences (see Sections 3.7.5, APPENDIX II.3 and APPENDIX II.2). We believe that this approach can, at least, inspire researchers and practitioners in future qualitative researches and systematic reviews.

Finally, the authors believe that not only software development industry, manufacturing industry, and IT industry, but also whole business industry, will benefit with these results. Improving the competitiveness of governments and companies through the improvement of their governance and management shall result in significant economic returns. We think the proposed approach can contribute to these goals. In a broader context, we presume that it might help any kind of organization to deliver value faster, better, and cheaper to the business.

APPENDIX III. SNME - Observing Professional Groups based on Social Networks

APPENDIX III.1. SNME: Protocol

Study: SNME - Observing Professional Groups based on Social Networks: inspired on meta-ethnographic approach

Investigators

Principal investigators:

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Dr. Philippe Kruchten, P. Eng., Professor
Department of Electrical and Computer Engineering (ECE), The University of British Columbia (UBC), Vancouver, Canada.

Co-investigator:

Alexandre José Henrique de Oliveira Luna, student at UFPE/ CIn, pursuing a Doctoral degree in Computer Science.

Overview

The Agile Governance Cell (AGC) of the Project Research Group (GP2) in the Computer Centre (CIn) at Federal University of Pernambuco (UFPE) is conducting a research to get a better understanding of the relevance of the Agile Governance topic.

In fact, this study is part of a wider research conducted by the investigators in order to identify application of agile capabilities on governance capabilities to improve business operations, as well as the expand the understanding of how these arrangements can help the organizations to attain greater enterprise agility and support its overall strategy.

We are inviting representative agents from the phenomena in study (see 0) to participate in an observational study of Professional Groups based on Social Networks seeking to investigate the application of agile capabilities on governance capabilities, their moderator factors and the eventual influence of environmental factors. This study will require regular visits of the researcher to professional group's website, to conduct observations, interactions, and eventually: interviews and surveys.

Purpose

The purpose of the study is to collect data about the characteristics of agility dimension upon governance capabilities of the organizations and their projects, to assess a representative model derived from a theory of how they are influenced by the variables from the external environment and by the moderator effect of the variables from the inner context, and which are the effects upon business operations.

We are specifically interested in understanding the factors that influence "team performance", and other organizational contexts derived from its arrangements, namely: projects, business

units, enterprise, and multi-organizational settings. Our intent is to use the knowledge gained during this study to develop guidelines that can be used by the industry for improve the performance of the organizations and its projects.

Participant profile

We are selecting Professional Groups based on Social Networks that match with the profile depicted In **Table III.1.** After conduct a systematic literature review about the state of the art of agile governance (Luna et al., 2014b) and debate its findings with scholars and practitioners, we have inferred that professional groups that match with the profile depicted in Table III.1, have a high probability to have among their members representative agents of the phenomena in study.

Table III.1 – Criteria to select Professional groups as samples of this study.

Criterion	Description
(1) Adherence	if the group has relationship with the phenomena under study.
(2) Focus	if the group has focus on industry or scientific issues.
(3) Composition	if the group is comprised by scholars and practitioners with experience on governance and/or agile methods.

Study procedure

The study data shall be gathered using the following selection mechanism:

Participant observation and interaction: The study co-investigator shall take a "fly-on-the-wall" approach observing members activities. It is expected the co-investigator will observe and interact with group members, by means of discussion topics, posts or inbox message. In addition, the co-investigator shall on occasion locate himself in the group forum and observes "day-in-life" activities of group members.

Confidentiality

No one other than the named investigators will have access to the verbatim data collected by this instrument. The study outcome shall be presented as a summary of gathered data, but no personally identifying information shall be reported.

Benefit

The participant will receive the following intangible benefits from participating in this study:

1. The summary of the results will be shared to the groups, when published. This information may be useful for improve the performance of their organizations and their projects.
2. Goodwill from participating in a study to investigate the application of agile capabilities on governance capabilities, their moderator factors and the eventual influence of environmental factors.

Contact for information about the study

If you have any concerns or desire further information with respect to this study, you may contact the co-investigator, Alexandre Luna (ajhol@cin.ufpe.br).

Contact for concerns about the rights of research subjects

If you have any concerns about your treatment or rights as a research subject, you may contact the Secretary of the Executive Board of Research (SEC-DPQ) in the UFPE Office for Research Affairs and Graduate Studies (PROPESQ) at +55 (81) 2126 7041 or dpq.propesq@ufpe.br.

Consent

Your participation in this study is entirely voluntary and you may refuse to participate or withdraw your data from the study at any time, before the completion of the observation. It is necessary only send to us an email requesting withdraw your data from the study.

Interaction with the co-investigator indicates your consent and support for this study on behalf of your organization and your organization's permission for the use of the provided data to the aims of this study.

References and Acknowledges

We are very grateful to Steve Adolph (Adolph, 2013) by the inspiration to adapt his protocols to our own context.

This protocol was elaborated based on the following references: (Adolph, 2013; Creswell, 2003; Freitas et al., 2000; Gil, 2009; Groves et al., 2013; Marin and Wellman, 2010; Murthy, 2008; Pinsonneault and Kraemer, 1993; Wolfe, 1997).

APPENDIX III.2. SNME: Data sampling

Follows further details about professional goups based on Social Networks with which we interact during this study, in order to characterize the sample.

Table III.2 – Observed professional groups based on social networks. Source: LinkedIn.

NG	Groups	Description and References	Members	Coverage	URL
01	**Governança de TIC**	This community seeks to investigate, develop, publish and promote a set of updated control objectives about IT Governance (national and international), focused to the everyday use of business managers, auditors and students.	1863	Brazil Created: November 17, 2008	https://www.linkedin.com/groups/Governança-TIC-1273567
02	**Brazilian Computing Society**	Group for members of the Brazilian Computing Society (Sociedade Brasileira de Computação), SBC	7248	Brazil Created: April 28, 2008	https://www.linkedin.com/groups/Brazilian-Computing-Society-95270
03	**Disciplined Agile Delivery**	The Disciplined Agile Delivery (DAD) decision process framework is a people-first, learning-	2435	International Created: October 24, 2012	https://www.linkedin.com/groups/Disciplined-Agile-Delivery-4685263

NG	Groups	Description and References	Members	Coverage	URL
		oriented hybrid agile approach to IT solution delivery.			
04	**Global Software Engineering**	Global Software Engineering (GSE) group aims at providing a platform for sharing and discussing information, experiences, news, and events related to research and practice covering different aspects of software development carried out by distributed teams or companies. One of the main goals of this group is to promote one of the premium conference seies on this topic: International Conference on Global Software Engineering (ICGSE).	2235	International Created: July 20, 2010	https://www.linkedin.com/groups/Global-Software-Engineering-3235627
05	**Governança Corporativa Brasil**	This group is focused on Corporate Governance	1975	Brazil Created: December 24, 2008	https://www.linkedin.com/groups/Governan%C3%A7a-Corporativa-Brasil-1599447
06	**Information Technology Audit and Governance Group**	This is LinkedIn's largest group focused on all things related to all areas of GRC[81], information technology audit, compliance, quality assurance, business continuity, disaster recovery, IT governance, fraud, risk, and forensics. We will maintain information, discussion, and resources for information technology auditors, internal auditors, application auditors, compliance,	53265	International Created: January 2, 2008	https://www.linkedin.com/groups/Information-Technology-Audit-Governance-Group-48549

[81] GRC is an acronym from Governance, Risk and Compliance.

NG	Groups	Description and References	Members	Coverage	URL
		information security and forensics professionals.			
07	**IT Service Management Forum**	This group is dedicated to provide and share Information Technology service management (ITSM) information and solutions based on Information Technology infrastructure library (ITIL) best practices.	57660	International Created: March 10, 2008	https://www.linkedin.com/groups/IT-Service-Management-Forum-68677
08	**ITIL & ISO20000 Service Management + ITSM Subgroups**	This group is suitable for all qualifications such as Green Badge Foundation, Blue Badge Practitioner/ Intermediate, Red/Lilac Badge Expert, Master / Advanced and ISO20000 Consultant and Auditor. Also complementary best practice such as PRINCE2, Agile, PMP, PMI, MSP, eTOM, Six Sigma, TOGAF, COBIT, CMMi.	135420	International Created: January 22, 2008	https://www.linkedin.com/groups/ITIL-ISO20000-Service-Management-ITSM-51930
09	**ITSM (ITIL) Professionals**	This is a group for ITSM (ITIL best practices) professionals to expand and exchange experience and ideas related with ITIL best practices approach for IT Service Management	98552	International Created: September 27, 2007	https://www.linkedin.com/groups/ITSM-ITIL-Professionals-31409
10	**PMI Project, Program and Portfolio Management**	This is an official LinkedIn Group of the Project Management Institute.	161165	International Created: February 19, 2010	https://www.linkedin.com/groups/PMI-Project-Program-Portfolio-Management-2784738
11	**The Project Manager Network**	The Project Manager Linkedin group is brought to you by ProjectManagers.net, the Social Network for Project Managers. It is a project	717565	International Created: October 17, 2007	https://www.linkedin.com/groups/Project-Manager-Network-1-Group-37888/

NG	Groups	Description and References	Members	Coverage	URL
		management forum and group. Members can use this LinkedIn group for discussions about project management, project software, project methodology, project management certification, or just to network locally for pm jobs and project management related business opportunities.			
12	**Agile Governance**	This professional group is meant for anyone interested in the theories and practices pertaining to Agile Governance.	74	International Created: January 31, 2012	https://www.linkedin.com/groups/Agile-Governance-4280613

APPENDIX III.3. SNME: Data collection sample - passive stage

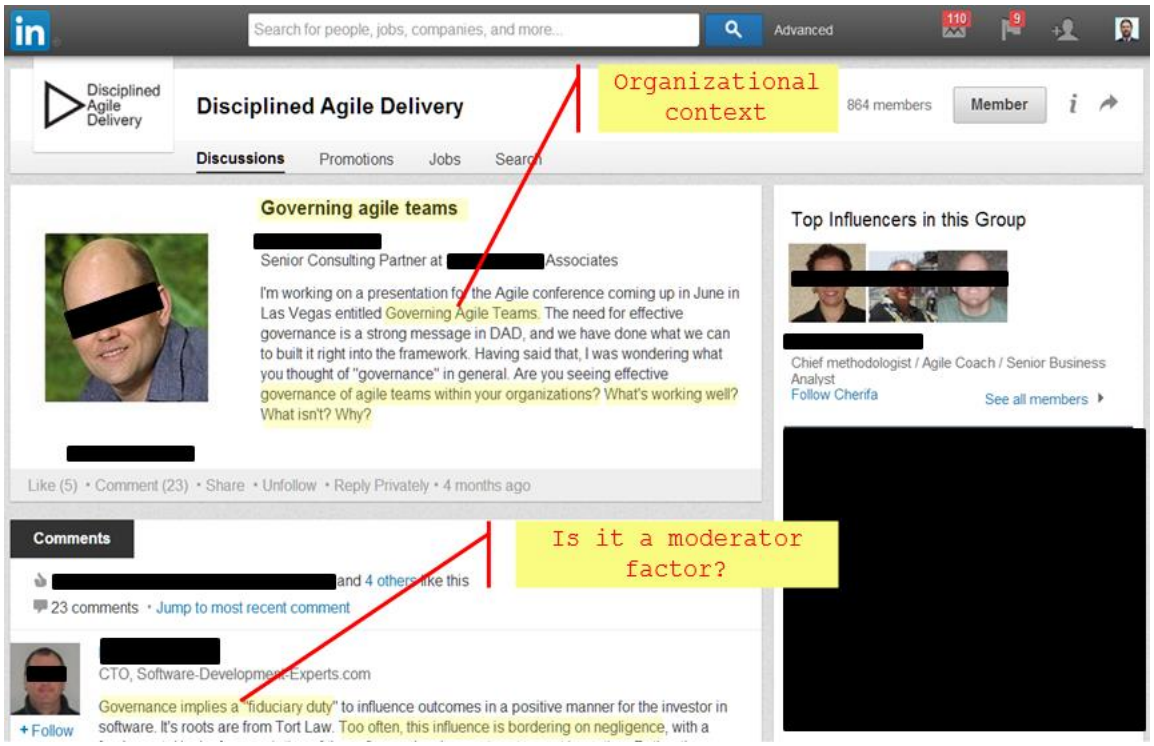

Figure III.1 – SNME Data collection sample: passive stage. Source: LinkedIn.

APPENDIX III.4. SNME: Data collection sample - active stage

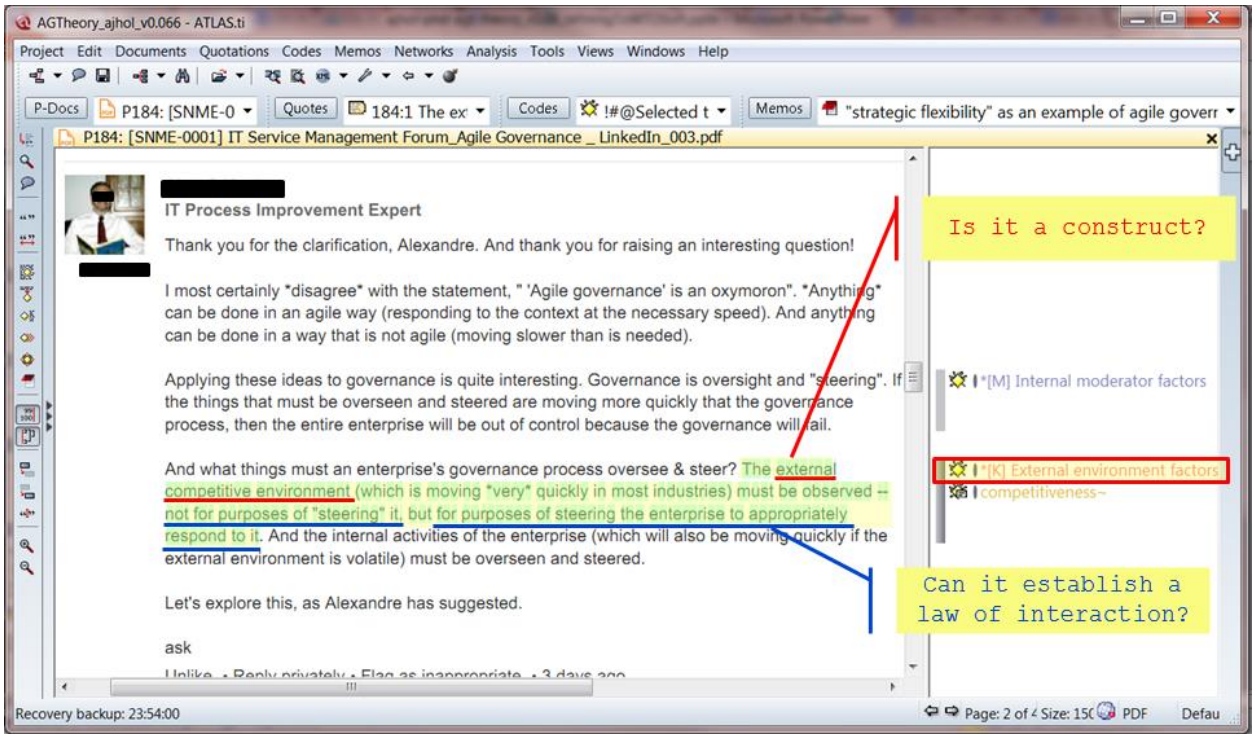

Figure III.2 – SNME Data collection sample: active stage. Source: LinkedIn.

APPENDIX IV. SSI: Semi-structured Interviews

APPENDIX IV.1. SSI: Protocol

Principal investigators

Dr. Hermano Perrelli de Moura, Professor
Computer Centre (CIn), Federal University of Pernambuco (UFPE), Recife, Brazil.

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Department of Electrical and Computer Engineering (ECE), The University of British Columbia (UBC), Vancouver, Canada.

Co-investigators

Alexandre José Henrique de Oliveira Luna, student at UFPE/ CIn, pursuing a Doctoral degree in Computer Science.

Overview

The Agile Governance Cell (AGC) of the Project Research Group (GP2) in the Computer Centre (CIn) at Federal University of Pernambuco (UFPE) is conducting a research to get a better understanding of the relevance of the Agile Governance topic.

In fact, this study is part of a wider research conducted by the investigators in order to identify application of agile capabilities on governance issues to improve business agility, as well as the expand the understanding of how these arrangements can help the organizations to attain greater enterprise agility and support its overall strategy.

We are inviting you to participate in interview of agile governance seeking to investigate the application of agile capabilities on governance issues, their moderator factors and the eventual influence of environmental factors. This study will require the recording of the interview for further analysis.

Purpose

The purpose of the study is to discuss some relevant aspects related to agile governance phenomena, by means of a semi-structured interview. We are specifically interested in understanding the factors that influence individuals, team performance and how it is perceived by the organizational context and its interactions with the external environment. Our intent is to use the knowledge gained during this study to develop guidelines that can be used by the industry for improve the performance of the organizations and its projects.

We are inviting you because **you have professional or academic experience compatible with the sample profile designed for this study**, being a representative agent of the phenomena in study, and possessing the expertise that is relevant to this study.

Study procedure

This is a semi-structured interview comprehending the following question profile:

Table IV.1 – Interview Profile

Question profile	Questions	%
Questions about the positioning of the subject mindset	2	8%
Questions about beaconing issues	3	12%
Questions about constructs and their relationships	6	23%
Questions related to respondent and its demography	10	38%
Questions related to Interview Analysis	5	19%
	26	100%

Relevant points:

(a) This interview takes, approximately, **60 minutes** to be completed.
(b) We kindly ask you to **answer all the questions**. Otherwise, we will have to discard it, since incomplete interviews are not considered valid for our study.
    a. If you do not feel comfortable in terms of knowledge to answer any of the questions, do not leave unanswered, you may feel comfortable in providing approximate answers. For research is more important an approximate answer than no response.
(c) This interview **must be answered only** by people who have had contact directly or indirectly with **agile methods** and **governance issues** in organizations of varied nature.
    a. Example of governance issues: business-driven, policy, accountability, control, compliance, decision making, strategic alignment, etc.
(d) To answer the questions **you must select only one of the criteria below**, you must enter it in the question that asks it, and use it (the same criterion) for answer all the questions. In case you have a broad experience about this topic, you should choose the predominant criterion that best fit your mindset to answer the questions:
    a. **Criterion (1)**: My **teamwork** experience
    b. **Criterion (2)**: My experience of participation in **projects**
    c. **Criterion (3)**: My experience working in sectors (**business units**) of the organization
    d. **Criterion (4)**: My experience working as an overall view of the operating of **entire organization**
    e. **Criterion (5)**: My experience working in a multi-organizational setting.

Confidentiality

No one other than the named investigators will have access to the verbatim data collected by this instrument. The study outcome shall be presented as a summary of gathered data, but no personally identifying information shall be reported.

Audio data shall be transcribed using a professional transcription service or by the investigators. Only the named investigators shall have access to the interview transcripts. The audio data, transcripts and field notes shall also be kept in a locked filing cabinet in the principal investigator's office. A back-up copy of the audio data will be made and stored in the co-investigators safety deposit box.

Remuneration/Compensation

No compensation shall be provided for participation in this study.

Benefit

The participant will receive the following intangible benefits from participating in this study:

- The summary of the results will be shared to the participants that fill their email in the related demographic question. This information may be useful for improve the performance of their organizations and their projects.
- Goodwill from participating in a study to investigate the application of agile capabilities on governance issues, their moderator factors and the eventual influence of environmental factors.

Contact for information about the study

If you have any concerns or desire further information with respect to this study, you may contact the co-investigator, Alexandre Luna (ajhol@cin.ufpe.br).

Contact for concerns about the rights of research subjects

If you have any concerns about your treatment or rights as a research subject, you may contact the Secretary of the Board of Research (SEC-DPQ) in the UFPE Office for Research Affairs and Graduate Studies (PROPESQ) at +55 (81) 2126 7041 or dpq.propesq@ufpe.br.

Consent

Your participation in this study is entirely voluntary and you may refuse to participate. Your signature below indicates that you have received a copy of this consent form for your own records.

Your signature indicates that you consent to participate in this study. In some cases, the record of verbal consent, captured by the audio recording of the interview, is sufficient evidence of their acceptance to participate in the interview and equivalent to your signature.

APPENDIX IV.2. SSI: Sample characterization

Follows further details about semi-structured interviews carried out by this study, in order to characterize the sample.

During interview the subjects were asked to answer the following question: "*What is your higher level of education (completed)?".* **Figure IV.1** depicts the Education profile of our sample.

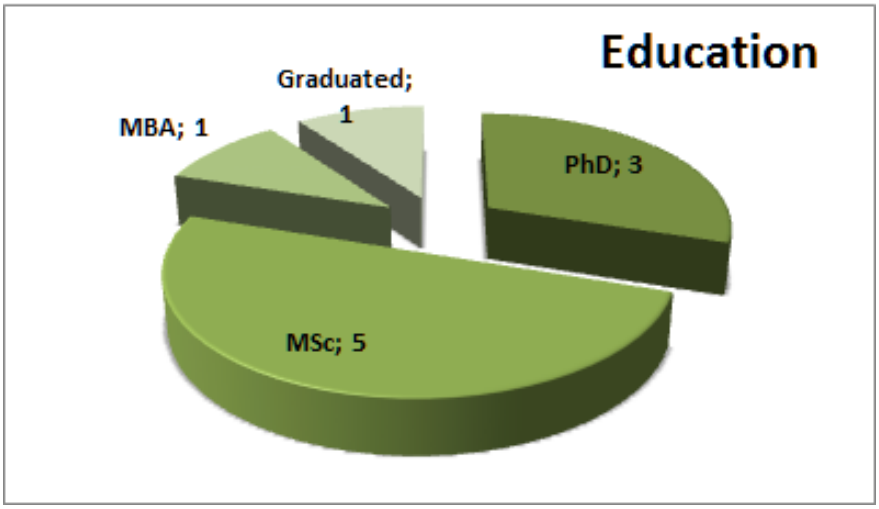

Figure IV.1 – SSI Sample characterization: educational profile ($\boldsymbol{n = 10}$). Source: From SSI sample.

The interviewers had the opportunity to describe their occupation. Some of them have declared more than one job position. This profile is depicted in **Figure IV.2**.

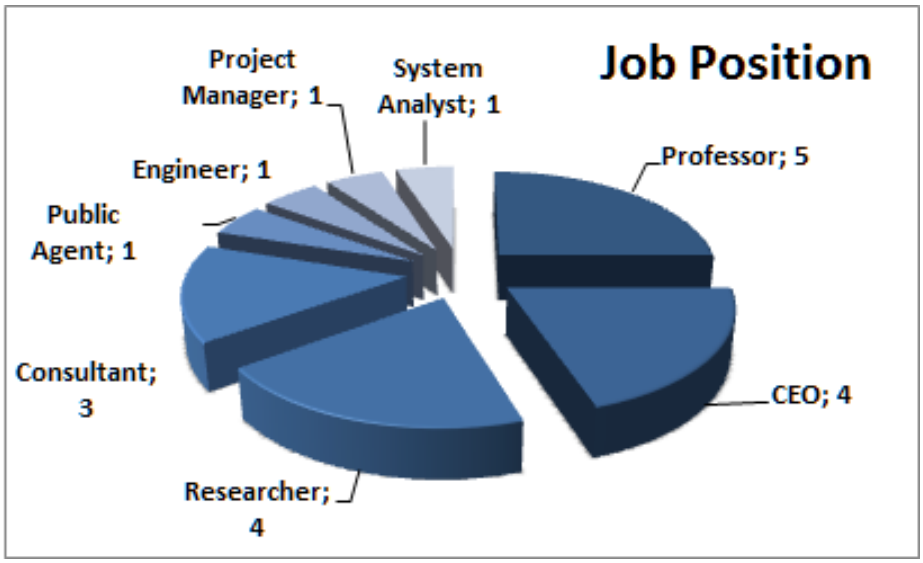

Figure IV.2 – SSI Sample characterization: job position ($\boldsymbol{n = 10}$). Source: From SSI sample.

Likewise, they have declared how long they are already working with governance and agile.

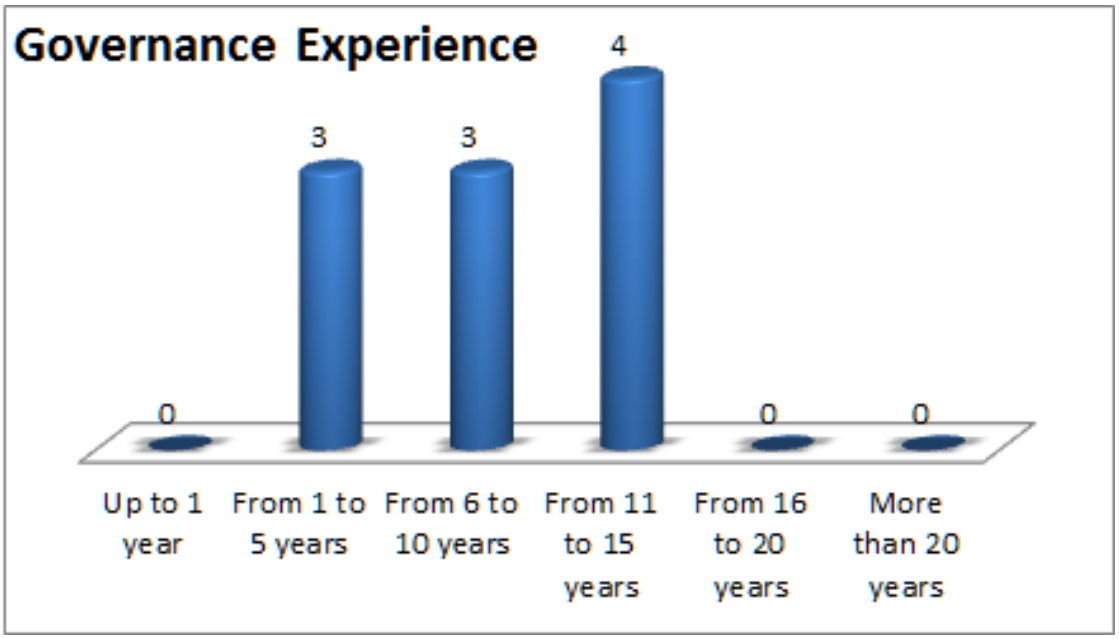

Figure IV.3 – SSI Sample characterization: governance experience ($\boldsymbol{n = 10}$). Source: From SSI sample.

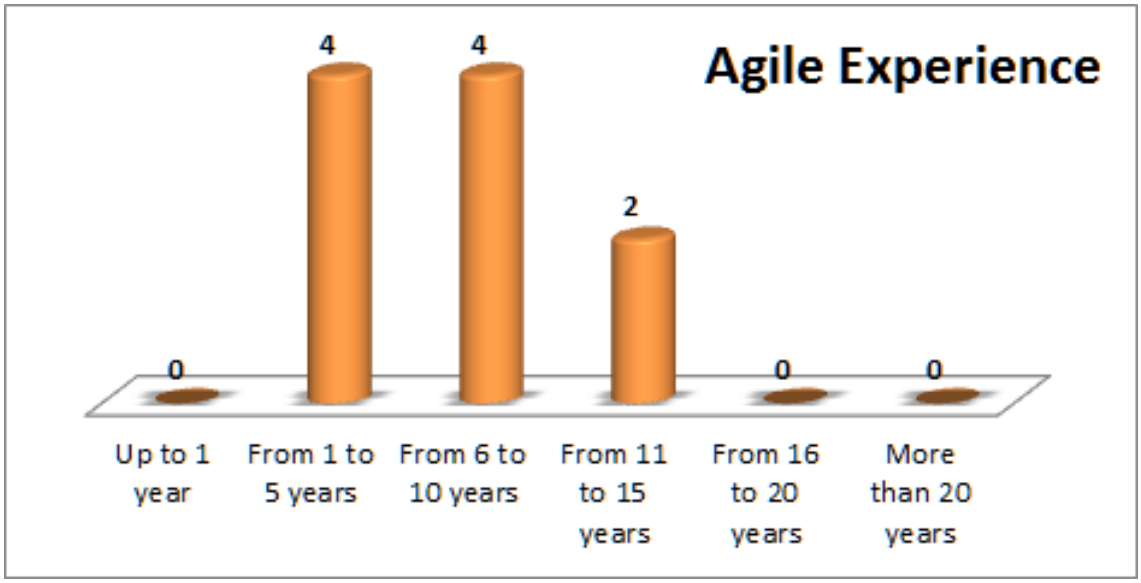

Figure IV.4 – SSI Sample characterization: agile experience ($\boldsymbol{n = 10}$). Source: From SSI sample.

The Subjects also provided information about the current organization where they were working, in the interview occasion.

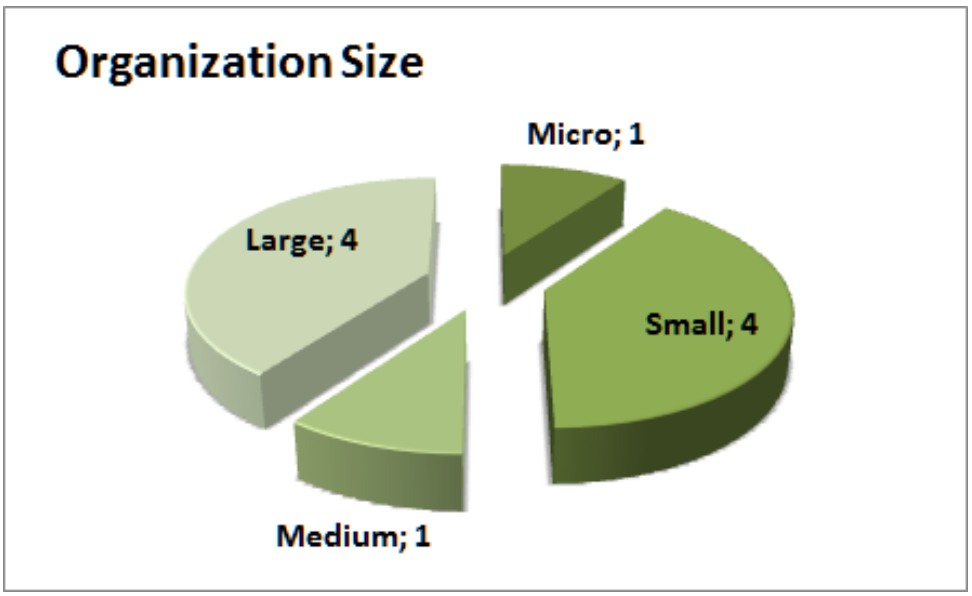

Figure IV.5 – SSI Sample characterization: organization size ($\boldsymbol{n = 10}$). Source: From SSI sample.

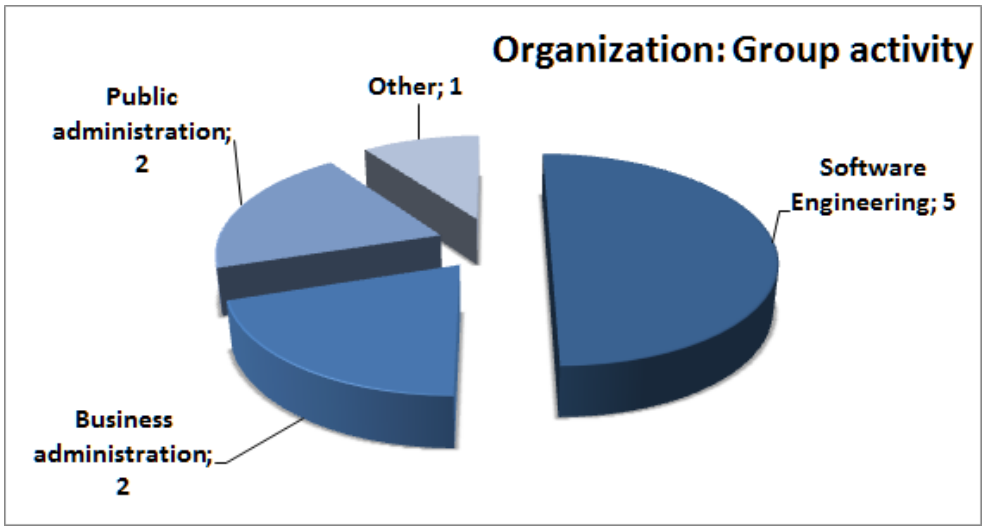

Figure IV.6 – SSI Sample characterization: organizational group activity ($\boldsymbol{n = 10}$). Source: From SSI sample.

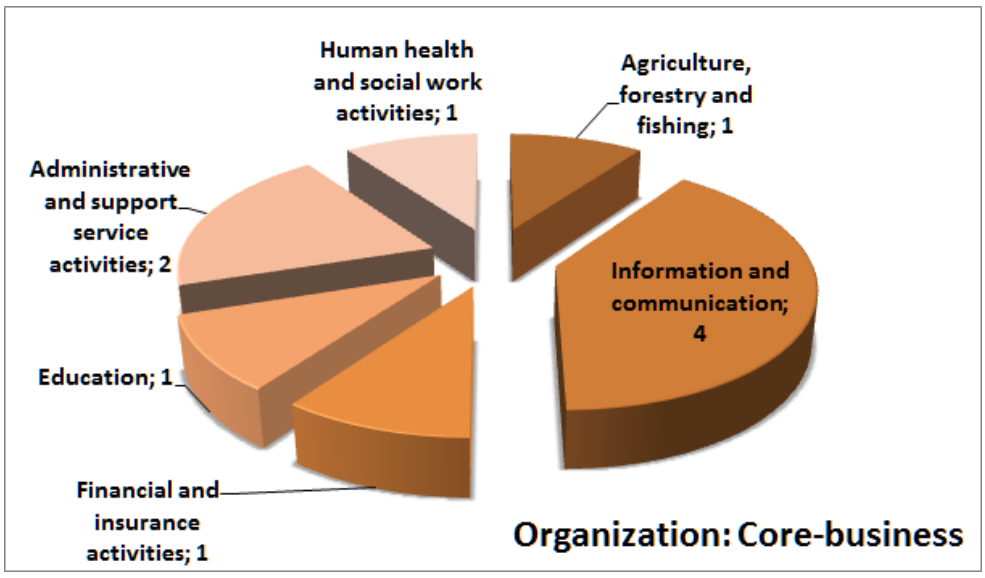

Figure IV.7 – SSI Sample characterization: core-business ($\boldsymbol{n = 10}$). Source: From SSI sample.

APPENDIX IV.3. SSI: Sample coded Interview

The **Figure IV.8** depicts a sample of the coded interview, related to the Subject IT-07.

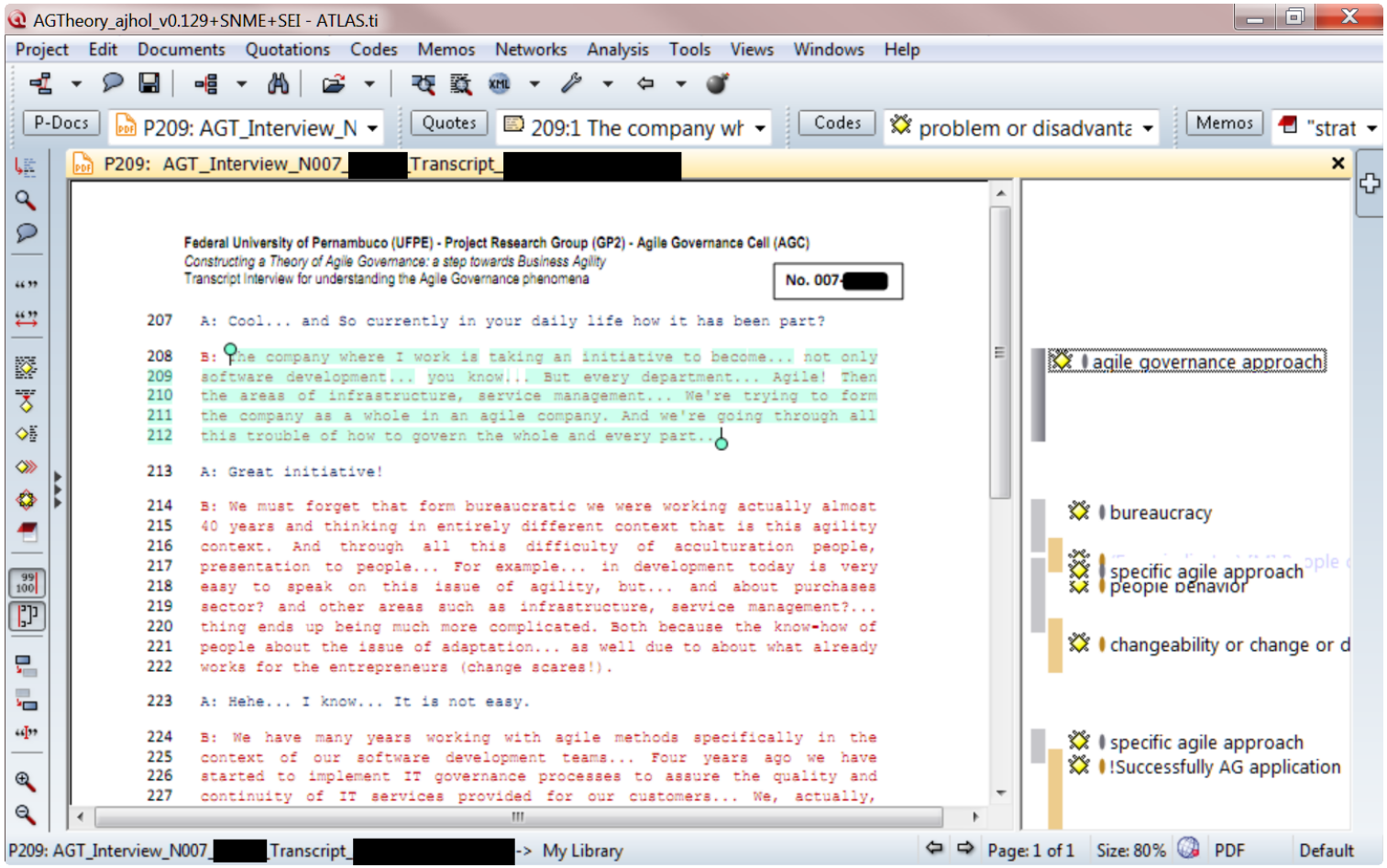

Figure IV.8 – Sample coded Interview. Source: From ATLAS.ti repository.

APPENDIX V. Theory Building

APPENDIX V.1. Further discussion about construct Validity

Regarding to construct validity, we will develop further discussion in the following sections, including a illustrative sample of their nomological networks.

V.1.1. Effects of environmental factors [E]

In favor of illustrate theory's unit validity, we present further evidences from the many data patterns that we found from every source of theoretical sampling employed in this study. These evidences are related to the influence caused by the external environment on distinct organizational contexts, concerned to the behavior: "*they potentially cause disturbing (or disquieting) effects on organizational context*". For instance:

(1) According to Schmidt and Mathiassen (2009) [S11], developing successful software in ***uncertain environments is challenging***, i.e., small software firms are ***vulnerable to environmental uncertainty***. While agile methods and other technologies offer suggestions to address this challenge, we know little about how these firms combine project and firm level capabilities to effectively ***respond to changes in their environment***. Implying the environmental ***uncertainty*** as a disturbing factor that can create challenging turbulences for small firms in software development industry.

(2) In addition, Vykoukal et al. (2011) [S21] provide and discuss the results of a survey conducted by (Eisenhardt and Martin, 2000) in the financial services industry in the U.S. to analyze the value-adding effects of **technology assimilation** on the operational agility of two specific business processes, as well as the role of **environmental turbulence** as an important moderator in organizational science. Highlighting the ability to respond to these disturbing effects as an essential to the business.

The **Table V**.1 depicts the density of evidences found in every data collection source established by this research, presenting a concrete testimony of the validity of this construct, highlighting

the number of quotes extracted from each source, and its respective references, totalizing **411 quotes** related with the *core layer*[82] of the *nomological network* depicted in **Figure V**.1.

Table V.1 – Effects of environmental factors [E]: construct validity references. Source: Own elaboration.

Evidences	Systematic Literature Review (SLR-AG)	Observation on professional groups based on Social Networks (SNME)	Semi-structured Interviews (SSI)	Other sources
Number of Quotes extracted	191	68	141	11
References (Primary-documents)	[S1], [S3-S11], [S15-S16], [S18-S21], [S23-S27], [S29], [S31-S33], [S37], [S42-S45], [S47], [S50-S51], [S53-S54], [S56], [S60-S61], [S68-S70], [S71-S73], [S75-S76], [S78-S83], [S85-S87], [S89-S90], [S92-S95], [S98], [S101-S102], [S106-S108], [S110], [S114-S115], [S118], [S121], [S125-S129], [S131-S139], [S142-S167]	[NG01], [NG03], [NG06], [NG07], [NG10], [NG11], [NG13]	[IT01], [IT02], [IT03], [IT04], [IT05], [IT06], [IT07], [IT08], [IT09], [IT10]	(Caligiuri, 2013; Chatwal et al., 2013; Chen et al., 2013; Jagodziski, 2010; Joshi et al., 2013; Pulipati, 2012; Smith, 2012; Su, 2012)

In addition, **Figure V**.1 depicts the relation among the concepts (codes) associated with the construct (category), the code frequency or "*groundedness*" (i.e., the number of quotations to which the code is applied), as well as the density of each concept (i.e., the number of links to other codes). These indicators are result of the axial coding procedure, i.e., the process of relating codes (categories and concepts) to each other, via a combination of inductive and deductive thinking.

Naturally, the objective of **Figure V**.1 is not discuss exhaustively every storyline emerging from the concepts and relations between them, neither to present every evidence (references from the sources of the theoretical sampling chosen) that have contributed to the nomological network supporting the construct validity in discussion. Indeed, this figure and the similar ones that will be presented in the following Sections, for each theory unit, are just a sample of their nomological networks, in order to allow to the reader to understand how this work was carried out.

[82] The nomological network *core layer* is comprised by the theory unit (construct in discussion) and its empirical indicators (main concept categories associated to it), disregarding the minor concepts associated with them.

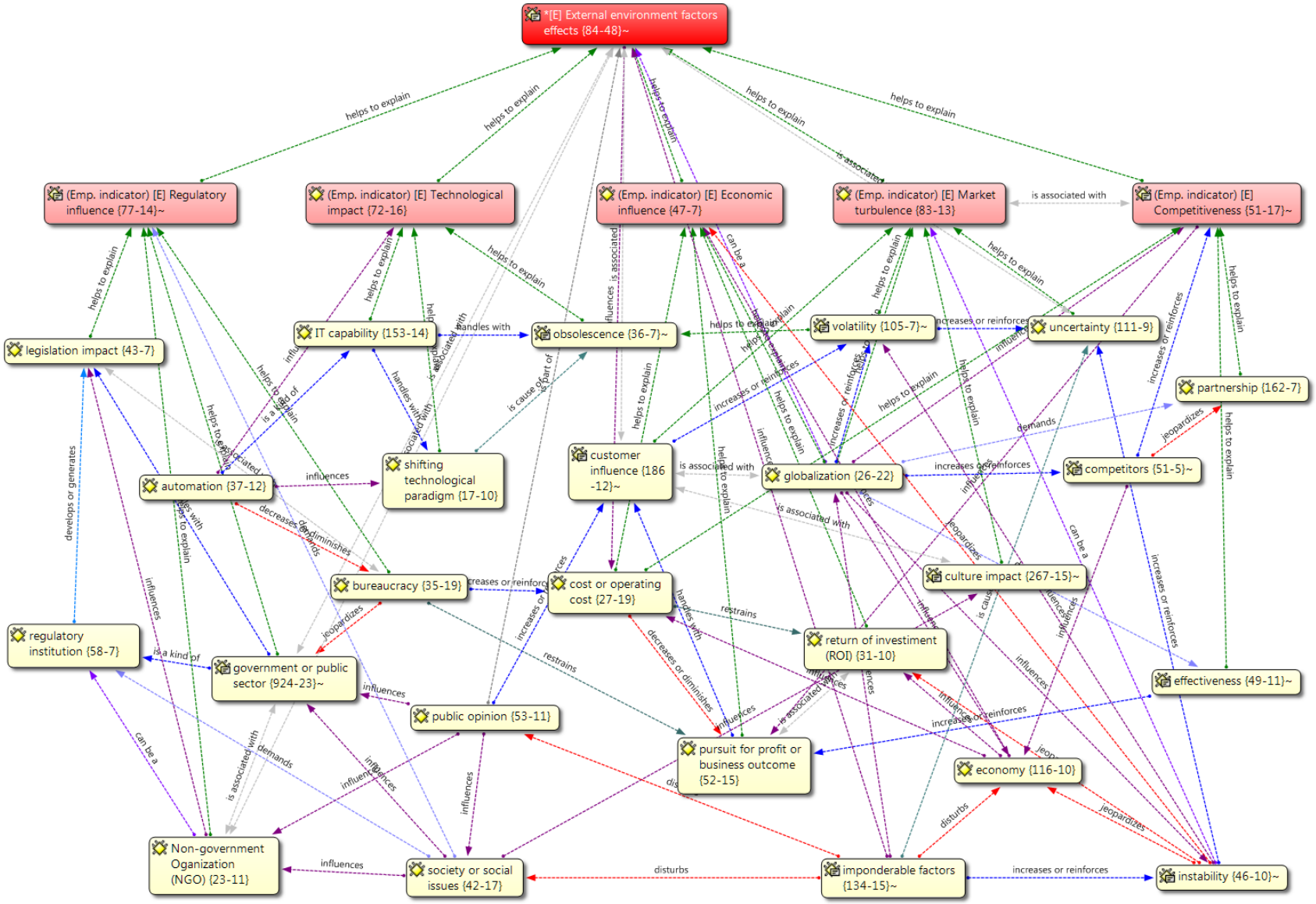

Figure V.1 – Effects of environmental factors (E): illustrative sample of the nomological network. Source: Own elaboration

V.1.2. Effects of moderator factors [M]

The "effects of moderator factors" emerged, from the triangulation among the data collection source of this research, as a category where fit several concepts related to the same pattern behavior: "*they potentially cause restraining (or limiting) effects on organizational context*". For instance:

(1) An IT Process Improvement Expert from Pennsylvania-US, points out, during a discussion in a social professional network about the "need of governance be agile": "*Applying these ideas to governance is quite interesting [agility and lean approach]. Governance is oversight and 'steering'. If the things that must be overseen and steered are moving more quickly that the **governance process**, then the entire enterprise will be out of control because the governance will fail.*" – [NG07, 191:1]. Inferring the ***lack of agility*** as a kind of moderator factor.

The **Table V**.2 depicts the density of evidences found in every data collection source established by this research, giving a concrete testimony of the validity of this construct, highlighting the number of quotes extracted from each source, and its respective references, totalizing **836 quotes** related with the *core layer* of the *nomological network* depicted in **Figure V**.2.

Table V.2 – Effects of moderator factors [M]: construct validity references. Source: Own elaboration.

Evidences	Systematic Literature Review (SLR-AG)	Observation on professional groups based on Social Networks (SNME)	Semi-structured Interviews (SSI)	Other sources
Number of Quotes extracted	708	40	76	12
References **(Primary-documents)**	[S4-S5], [S7-S9], [S11-S16], [S18-S19], [S21], [S23-S27], [S27], [S29-S30], [S45], [S49], [S51], [S55-S57], [S59-S62], [S68], [S70], [S72-S77], [S80-S93], [S98], [S100-103], [S106], [S108], [S111-S112], [S114-S116], [S118-S120], [S122-S124], [S126], [S131-S132], [S134-S136], [S138-S141], [S143], [S145-S147], [S149-S151], [S153], [S158], [S160-S165]	[NG02], [NG03], [NG07], [NG08], [NG09], [NG10], [NG11]	[IT01], [IT02], [IT03], [IT04], [IT05], [IT06], [IT07], [IT08], [IT09], [IT10]	(Brown, 1997; Caligiuri, 2013; Pulipati, 2012; Smith, 2012; Weill and Ross, 2004a, 2004b)

In addition, **Figure V**.2 depicts the relation among the concepts (codes) associated with the construct (category), the code frequency or "*groundedness*" (i.e., the number of quotations to which the code is applied), as well as the density of each concept (i.e., the number of links to other codes). These indicators are result of the axial coding procedure, i.e., the process of relating codes (categories and concepts) to each other, via a combination of inductive and deductive thinking.

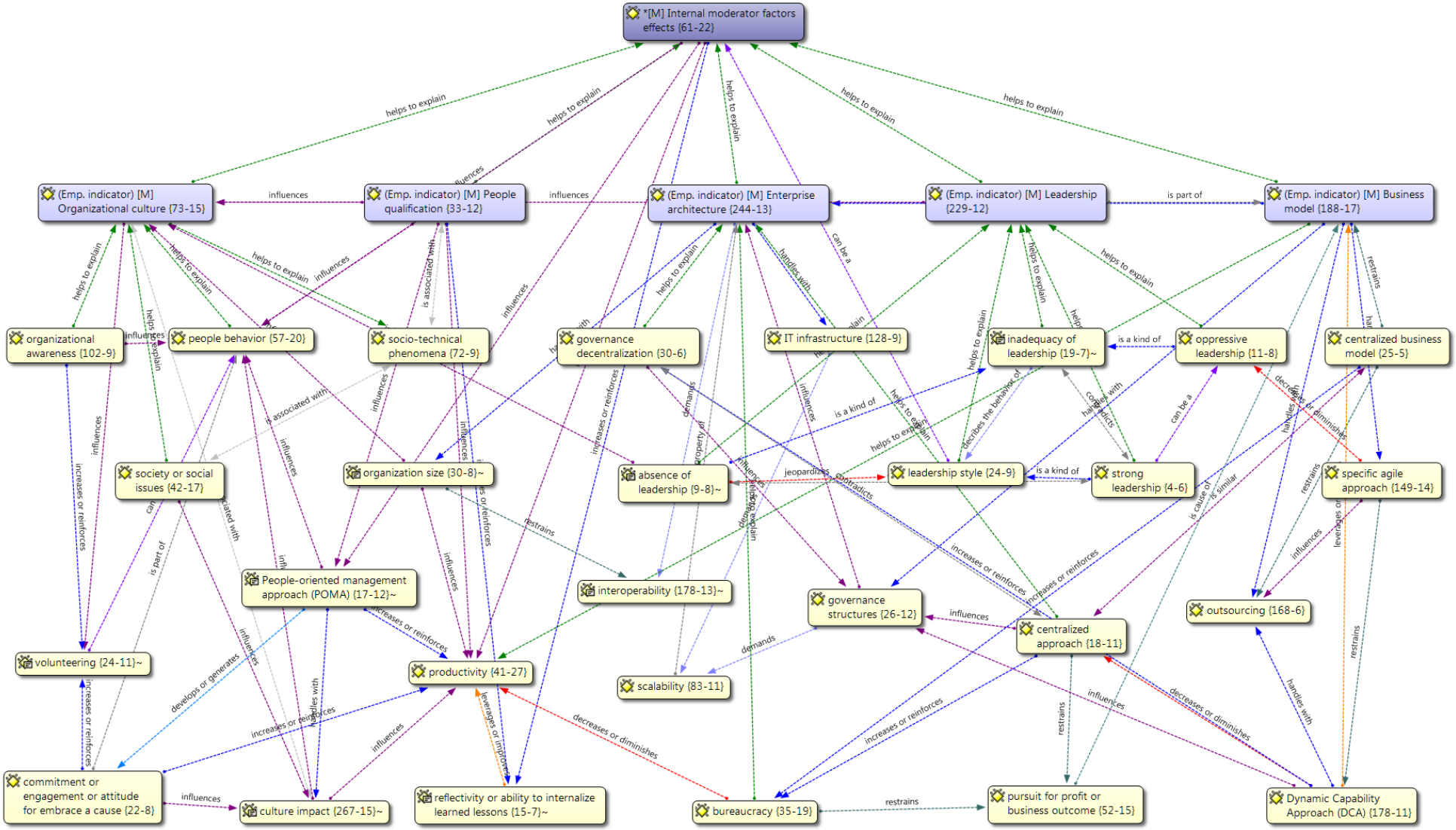

Figure V.2 – Effects of moderator factors [M]: illustrative sample of the nomological network. Source: Own elaboration.

V.1.3. Agile capabilities [A]

Such adaptive behaviors are enabled by specific dynamic capabilities, which, according to our theory, are part of the coordinated combination of agile [A] and governance [G] capabilities. We can provide more examples, such as:

(1) As stated in Schmidt and Mathiassen (2009) [S11], the coupling between organizational knowledge and dynamic capabilities is further investigated in (Prieto and Easterby-Smith, 2006). In the context of small firms, special characteristics for dynamic capabilities emerge; they become more fluid and simple, further requiring the firm to emphasize continuous knowledge creation and flexible production cycles (Eisenhardt and Martin, 2000).

(2) According to Chen et al. (2008) [S86], the dynamic capabilities perspective is similar to the co-evolutionary approach manifest in biology and the study of natural sciences. In this context, the term is used to explain the mutual evolution between two or more species. Each species in co-evolution exerts selective pressures on the other to influence or affect the evolution of both. The IT co-evolutionary processes take place in firms based on their relationship with markets.

(3) In addition, Imache et al. (2012) [S146] points out that Galliers (2006) studied the agility in the strategy point of view by suggesting a framework for IS strategizing ("strategic agility" as an agile governance capability [A]), and mentions that there are three main points for strategizing agility: (1) the exploitation strategy: concerns the environmental and organizational analysis, the enterprise information and knowledge systems, the standardized procedures and rules, and the information services; (2) the exploration strategy: it is related on the alternative futures of information systems, the existing communities of practice, the flexibility of project teams, the existence of knowledge brokers, and the possibility of cross-project learning; and (3) the change management strategy: it depends on the ability to incorporate the ongoing learning and review.

(4) Moreover, Roberts and Grover (2012) [S152] advocate that agility consists of two components—sensing and responding—that are key organizational capabilities that contribute to success in hypercompetitive environments. They complement that a firm may be agile in various areas, such as its customer-based processes, interactions with supply chain partners, and day-to-day operations. As a consequence they focus on firm's

customer agility, which is defined as the degree to which a firm is able to sense and respond quickly to customer-based opportunities for innovation and competitive action.

(5) Yang and Liu (2012) [S166] state that this perspective is also supported by Yusuf et al. (1999), who stated that agility refers to the successful exploration of competitive strategies including speed, quality, flexibility, innovation, proactivity, and profitability through the synthesized utilization and reconfiguration of extant resources and developed technologies. Thus, agility is regarded as a holistic strategy that is constructed on the extant capabilities of a lean or flexible strategy and then integrates parts of these capabilities into a new firm capability in order to adapt to unanticipated and sudden changes in the business environment.

(6) Besides, an experienced IT management consulting from Oregon-US, highlights that "*Agile governance must put flexible, adaptive decision processes in place so we can practice in rapid cycles and make well informed decisions based upon what we learn. That is working with uncertainty, treating continuous change as an ally, rather than something that has to be 'controlled'. This is a significant mental model that must be addressed if Agile is to thrive across the enterprise, rather than in isolated pockets.*" – [NG03, 186:35].

The **Table V**.3 depicts the density of evidences found in every data collection source established by this research, giving a concrete testimony of the validity of this construct, highlighting the number of quotes extracted from each source, and its respective references, totalizing **916 quotes** related with the *core layer* of the *nomological network* depicted in **Figure V**.3**.**

In addition, **Figure V**.3 depicts the relation among the concepts (codes) associated with the construct (category), the code frequency or "*groundedness*" (i.e., the number of quotations to which the code is applied), as well as the density of each concept (i.e., the number of links to other codes). These indicators are result of the axial coding procedure, i.e., the process of relating codes (categories and concepts) to each other, via a combination of inductive and deductive thinking.

Table V.3 – Agile capabilities [A]: construct validity references. Source: Own elaboration.

Evidences	Systematic Literature Review (SLR-AG)	Observation on professional groups based on Social Networks (SNME)	Semi-structured Interviews (SSI)	Other sources
Number of Quotes extracted	763	20	27	106
References (Primary-documents)	[S4-S5], [S7], [S9-S11], [S13-S16], [S19], [S21], [S23-32], [S34], [S36-S37], [S39-S43], [S48-S49], [S52], [S59-S60], [S62], [S64-S65], [S67], [S69], [S73], [S75-S77], [S80-S82], [S84-S89], [S93], [S101-S102], [S104-S108], [S114-S115], [S117], [S120], [S123-S124], [S126-S136], [S138-S167]	[NG01-NG03], [NG07-NG10]	[IT01-IT03], [IT06-IT07], [IT09-IT10]	(Caligiuri, 2013; Chatwal et al., 2013; Chen et al., 2013; Glover et al., 2013; Hayata et al., 2012; Jagodziski, 2010; Jones et al., 1997; Joshi et al., 2013; Nascimento and Oliveira, 2012, 2013; Ozelkan et al., 2013; Pulipati, 2012; Smith, 2012; Su, 2012)

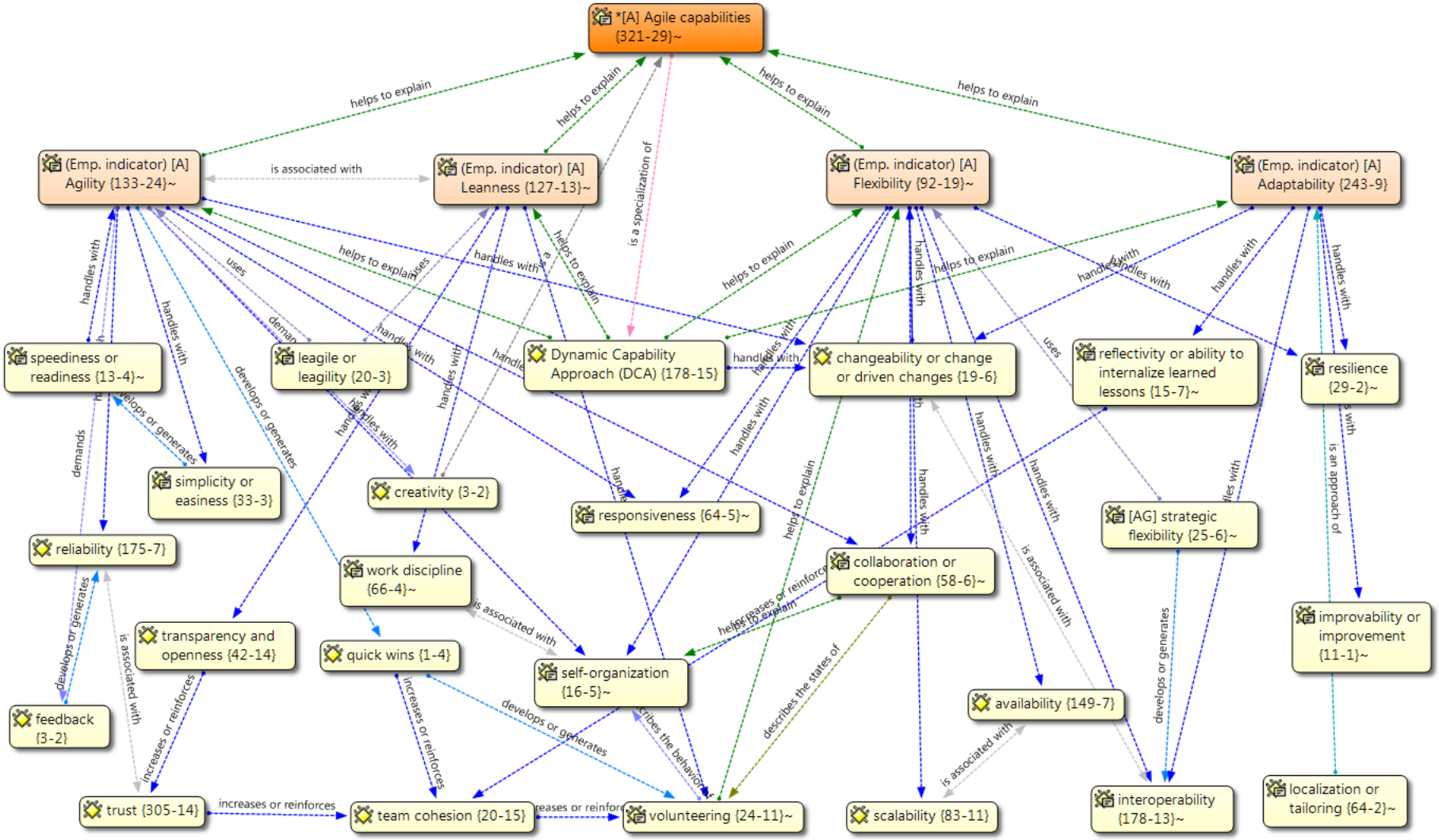

Figure V.3 – Agile capabilities [A]: illustrative sample of the nomological network. Source: Own elaboration.

V.1.4. Governance capabilities [G]

Its “steering capabilities” [G] are developed and enabled by specific dynamic capabilities, which, according to our theory, achieve better results when coordinated and combined with agile capabilities [A]. Some examples can be provided, such as:

(1) Pettit (2006) advocates that as competitive and regulatory business pressures increase, so shall the pressure for more mature governance. If it is imposed by the business, IT will struggle to evolve its ***governance capability*** beyond "measuring to plan". Should this be the case, IT will be consider more of a cost center or tolerated nuisance of doing business. Alternatively, governance can be initiated from within IT, and done specifically as a means by which to engender *organizational agility*. In this case, IT will increasingly be able to evaluate value delivered given evolving business conditions, and will increasingly become *drivers of business imperative*.

(2) In complement, Pardo and Burke (2009) report the experience from Center for Technology in Government, University at Albany, New York (CTG) with New York State government. They have conducted current practices review of IT governance in the public sector and interviews with state-level IT leaders from U.S. state governments. As a result of these findings the authors inform a new yet important perspective for governments attempting to improve their ***IT governance capabilities***.

(3) Termeer et al. (2013) explore an integrative approach for dealing with wicked problems, suggesting ***four governance capabilities*** to do that: (a) **reflexivity**: as the capability to deal with multiple frames; (b) **resilience**: as the capability to adjust actions to uncertain changes; (c) **responsiveness**: as the capability to respond to changing agendas and expectations; (d) **revitalization**: as the capability to unblock stagnations.

The **Table V**.4 depicts the density of evidences found in every data collection source established by this research, giving a concrete testimony of the validity of this construct, highlighting the number of quotes extracted from each source, and its respective references, totalizing **2076 quotes** related with the *core layer* of the *nomological network* depicted in **Figure V**.4.

Table V.4 – Governance capabilities [A]: construct validity references. Source: Own elaboration.

Evidences	Systematic Literature Review (SLR-AG)	Observation on professional groups based on Social Networks (SNME)	Semi-structured Interviews (SSI)	Other sources
Number of Quotes extracted	2024	35	6	11
References (Primary-documents)	[S2], [S4-S9], [S11], [S15], [S27], [S60-S112], [S114-S121], [S123-S132], [S134-S137], [S139-S147], [S149-S158], [S160-S167]	[NG01-NG03], [NG06], [NG11]	[IT01], [IT05], [IT07]	(Joshi et al., 2013; Pulipati, 2012; Smith, 2012; Su, 2012)

In addition, **Figure V**.4 depicts the relation among the concepts (codes) associated with the construct (category), the code frequency or "*groundedness*" (i.e., the number of quotations to which the code is applied), as well as the density of each concept (i.e., the number of links to other codes). These indicators are result of the axial coding procedure, i.e., the process of relating codes (categories and concepts) to each other, via a combination of inductive and deductive thinking.

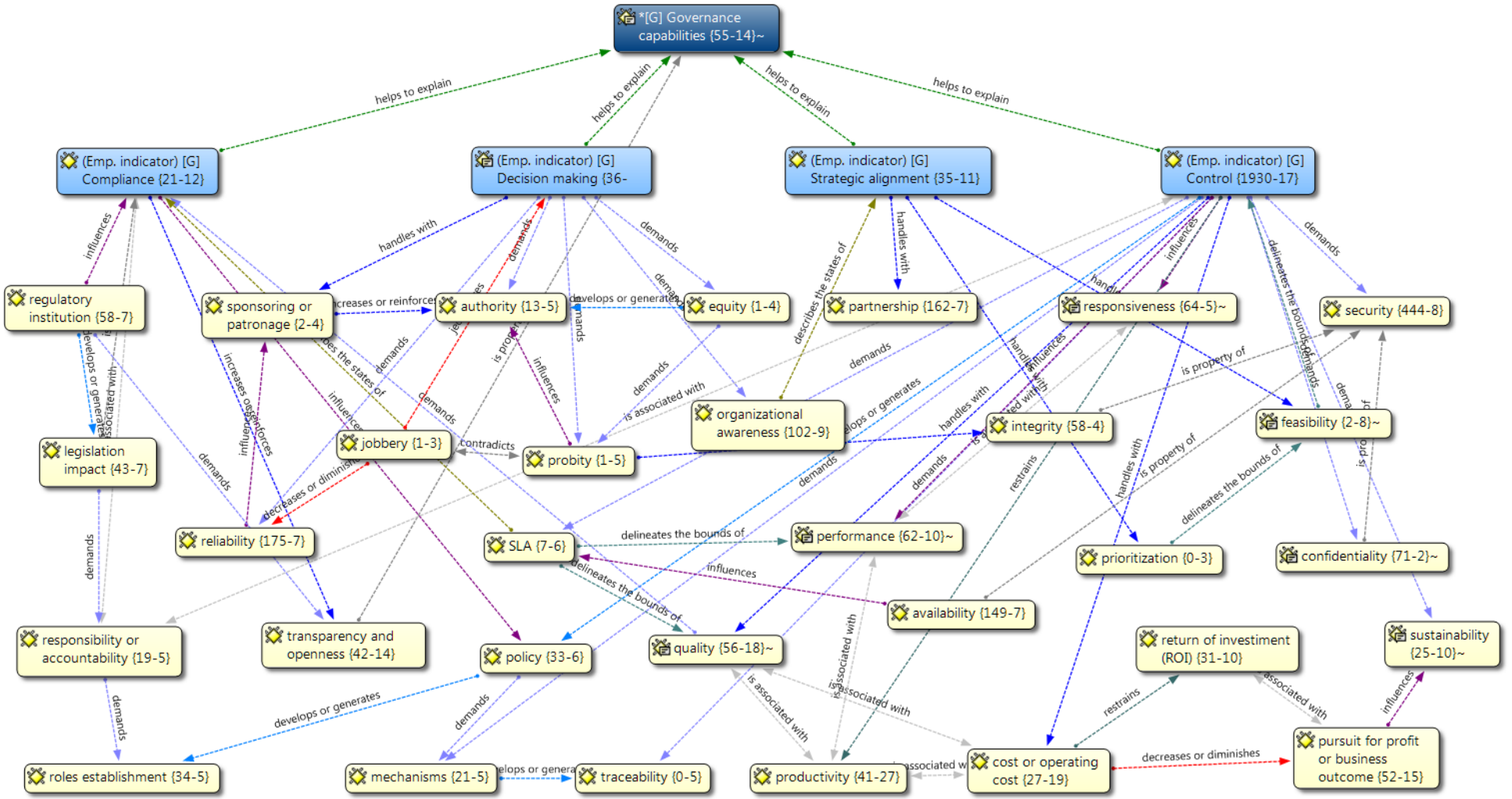

Figure V.4 – Governance capabilities [G]: illustrative sample of the nomological network. Source: Own elaboration.

V.1.5. Business operations [B]

The "business operations" emerged, from the triangulation among the data collection source of this study, as a category where fit several concepts related to the same pattern behavior: "*organized activities involved in the day to day functions of the business, conducted for the purpose of generating value delivery*". For instance:

(1) Kancharla (2007) [S58] explains how *Tata Motors in India* is trying to apply Lean Governance to force multiplier for achieving the outsourcing objectives of both ***business operations*** and IT dimensions, based on the case study from Tata Consultancy Services (TCS) experiences and ongoing relationships with its customers.

(2) Wang, Lane, Conboy and Pikkarainen (2009) [S17] conducted a workshop called "Agile Research – A 7-Year Retrospective". This workshop, which aimed to investigate *"where the agile research goes"*, was based on an open discussion around past papers presented at the *International Conference on Agile Processes and eXtreme Programming in Software Engineering* (XP2009), identifying current gaps and areas for future research. From the sample of 161 papers published on this conference, they classified ten of them as related to the emerging area of **business agility**, which was pointed out as one of *six emerging trends* that must be explored and studied and points the direction for where ***agile research goes***.

(3) Talby & Dubinsky (2009) [S73] describe the experience of the *Israeli Air Force in Israel* to employ governance of agile software teams in consideration of becoming more effective the ***development software processes*** for large-scale and mission critical projects.

(4) Gong & Janssen (2010) [S4] discuss the approach to measure the process flexibility and agility in the *Dutch Immigration and Naturalization Service in Netherlands* (*Immigratie en Naturalisatiedienst*, IND), in order to improve their systems and architectures, applying agility and flexibility in their ***business processes***. In another study, Gong & Janssen (2012) [S142] present a flexible and agile policy implementation in the *Dutch Tax and Customs Administration (DTCA)*, where the policy makers and policy executors were searching for ways to achieve higher levels of flexibility and agility in their business process management systems.

(5) Carter et al. (2011) [S93] describe adoption of lean techniques in *British civil service* enhancing the ***effectiveness of the back office clerical work***, specifically in the *Her Majesty's Revenue and Customs (HMRC)*.

(6) Parcell & Holden (2013) [S153] report application of ***agile capabilities to accelerate the policy development process*** for digital government in four *U.S. federal agencies*.

(7) Deshmukh (2013) [S134] advocates that according to World Economic Forum , simply tailoring the ***business models*** to suit the need of emerging markets featuring low-medium income consumers will not lead to the profitability, however products, ***business processes*** & channels innovation can accommodate the low income dynamics of emerging world. According her, these trends in the new world order force the ***Business Process Strategies*** to be revaluated to ingrain agility.

(8) Janssen & Estevez (2013) [S147] define *t-Government* as the 'ICT-enabled and organization-led transformation of ***government operations***, internal and external processes and structures to enable the realization of services that meet public-sector objectives such as *efficiency*, *transparency*, *accountability* and *citizen centricity*'. An essential topic is the renewed focus on ICT-driven ***business process*** *reengineering* and *design*.

The **Table V**.5 depicts the density of evidences found in every data collection source established by this research, giving a concrete testimony of the validity of this construct, highlighting the number of quotes extracted from each source, and its respective references, totalizing **1059 quotes** related with the *core layer* of the *nomological network* depicted in **Figure V.5**

In addition, **Figure V.5** depicts the relation among the concepts (codes) associated with the construct (category), the code frequency or "groundedness" (i.e., the number of quotations to which the code is applied), as well as the density of each concept (i.e., the number of links to other codes). These indicators are result of the axial coding procedure, i.e., the process of relating codes (categories and concepts) to each other, via a combination of inductive and deductive thinking.

Table V.5 – Business operations [B]: construct validity references. Source: Own elaboration.

Evidences	Systematic Literature Review (SLR-AG)	Observation on professional groups based on Social Networks (SNME)	Semi-structured Interviews (SSI)	Other sources
Number of Quotes extracted	997	23	10	29
References (Primary-documents)	[S1-S9], [S12-S14], [S16-S17], [S19-S23], [S25], [S27-S29], [S31-S32], [S34], [S36], [S39-S46], [S48], [S50], [S52-S54], [S56], [S58-S62], [S64], [S66], [S68-S70], [S72], [S75-S77], [S79-S80], [S82-S83], [S85], [S87-S94], [S96], [S98-104], [S106-S110], [S112], [S114-S120], [S122-S129], [S131-S149], [S151-S154], [S157-S165], [S167]	[NG02-NG03], [NG06-NG11]	[IT01-IT10]	(Chatwal et al., 2013; Chen et al., 2013; Glover et al., 2013; Hayata et al., 2012; Herzum, 2013; Joshi et al., 2013; Nascimento and Oliveira, 2012, 2013; Ozelkan et al., 2013; Su, 2012)

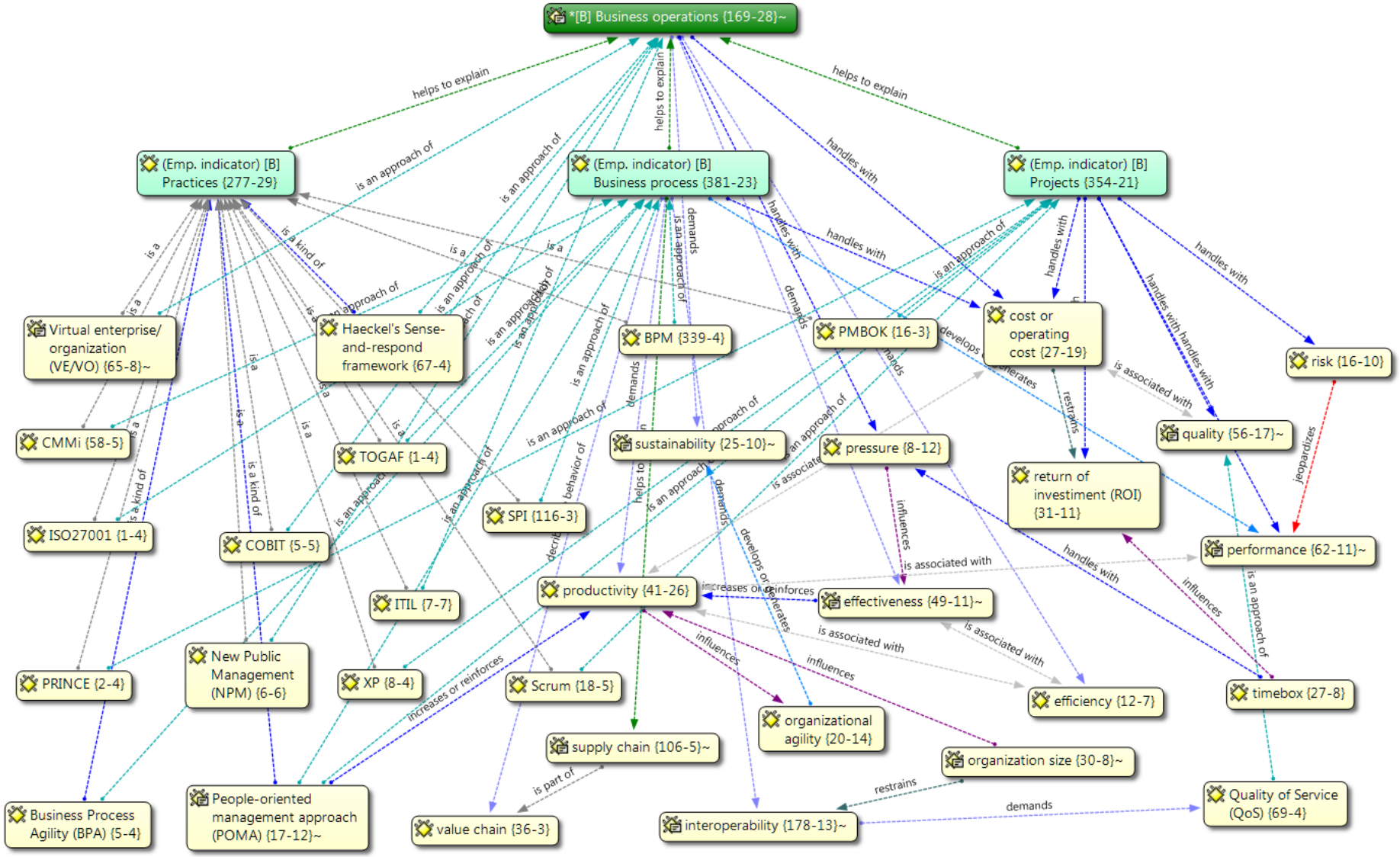

Figure V.5 – Business operations [B]: illustrative sample of the nomological network. Source: Own elaboration.

V.1.6. Value delivery (R)

In favor of illustrate theory's unit validity, we present a sample from the many data patterns that we found from every source of theoretical sampling employed in this study. These evidences are related to the influence caused by the external environment on distinct organizational contexts, concerned to the behavior: "*the ability to generate results to the business by means of the delivery of value*". For instance:

(1) Abbas, Gravell and Wills (2010) [S66], using Factor Analysis, points out that correlation was used to test the relationship between ***project success*** and the different metrics, the results showed that there is a *positive significant relationship* between **project success** and "***business value delivered***".

The **Table V**.6 depicts the density of evidences found in every data collection source established by this research, giving a concrete testimony of the validity of this construct, highlighting the number of quotes extracted from each source, and its respective references, totalizing **294 quotes** related with the *core layer* of the *nomological network* depicted in **Figure V**.6.

Table V.6 – Value delivery [B]: construct validity references. Source: Own elaboration.

Evidences	Systematic Literature Review (SLR-AG)	Observation on professional groups based on Social Networks (SNME)	Semi-structured Interviews (SSI)	Other sources
Number of Quotes extracted	169	11	108	6
References (Primary-documents)	[S1], [S4-S5], [S7], [S9-S11], [S13], [S16], [S18-S22], [S32], [S36], [S43-S47], [S52], [S54], [S57-S58], [S60-S64], [S66], [S73-S75], [S78], [S80], [S82-S84], [S89-S91], [S101-S106], [S109], [S112], [S114-S118], [S121], [S128-S129], [S133-S137], [S139-S140], [S142], [S144-S145], [S151-S155], [S160-S163], [S165]	[NG03-NG05], [NG08], [NG11]	[IT01-IT10]	(Jagodziski, 2010; Ozelkan et al., 2013; Weill and Ross, 2004a)

In addition, **Figure V**.6 depicts the relation among the concepts (codes) associated with the construct (category), the code frequency or "*groundedness*" (i.e., the number of quotations to which the code is applied), as well as the density of each concept (i.e., the number of links to

other codes). These indicators are result of the axial coding procedure, i.e., the process of relating codes (categories and concepts) to each other, via a combination of inductive and deductive thinking.

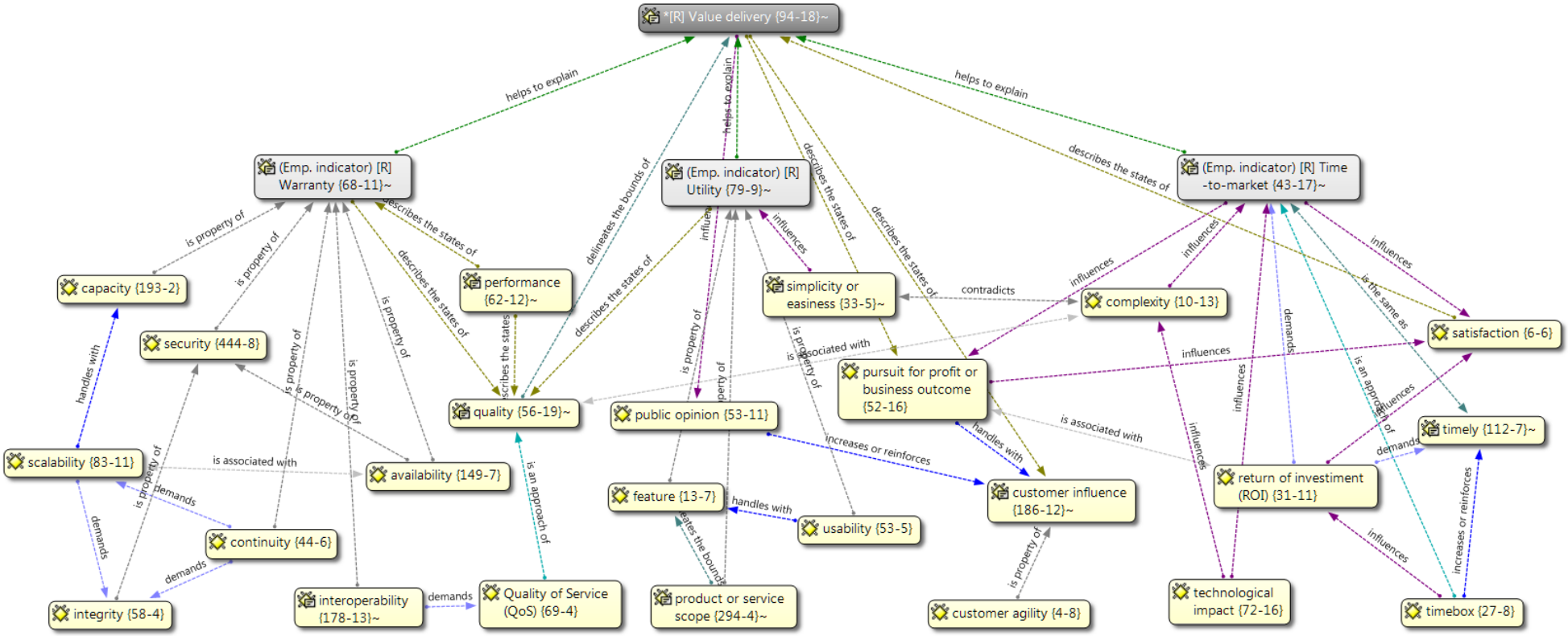

Figure V.6 – Value delivery [R]: illustrative sample of the nomological network. Source: Own elaboration

APPENDIX VI. Explanatory Survey: Overview

APPENDIX VI.1. Survey: Pilot sampling

Follows further details about the Pilot of the Explanatory Survey, carried out by this study, in order to characterize the sample.

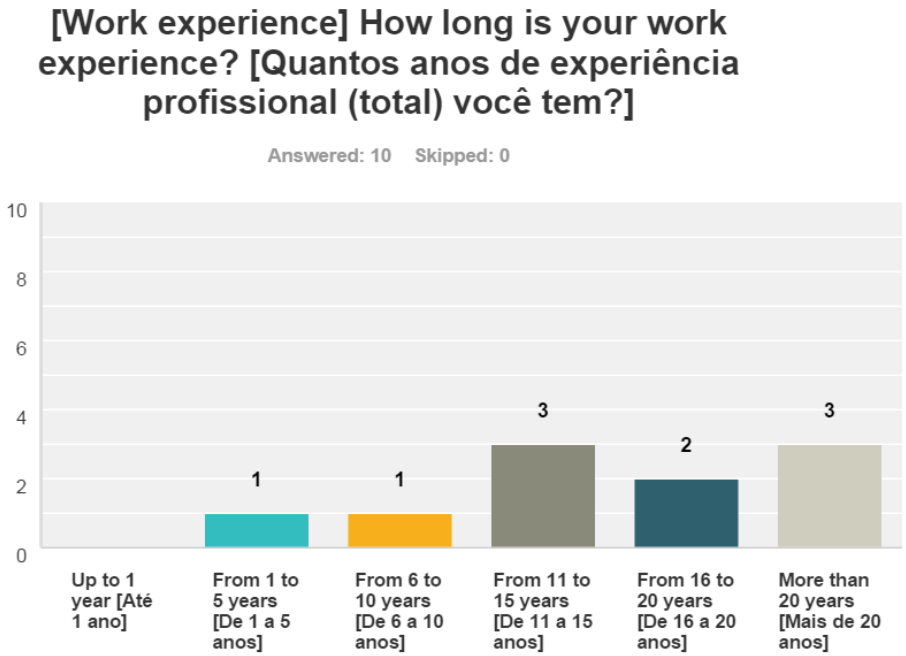

Figure VI.1 – Survey Pilot: respondents experience ($\boldsymbol{n = 10}$). Source: Data repository on SurveyMonkey.

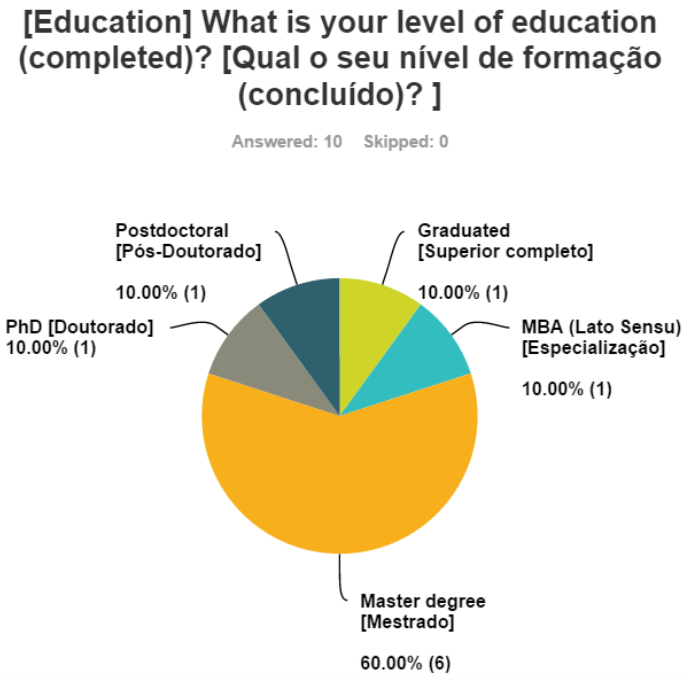

Figure VI.2 – Survey Pilot: respondents education ($\boldsymbol{n = 10}$). Source: Data repository on SurveyMonkey.

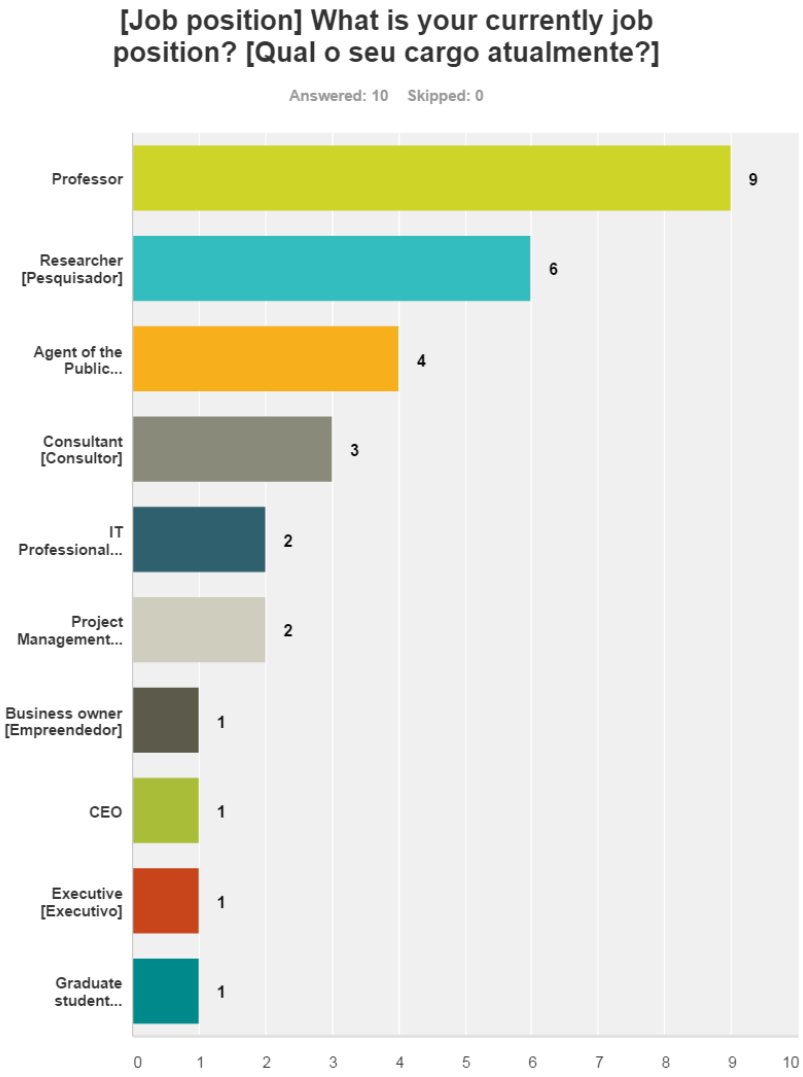

Figure VI.3 – Survey Pilot: respondents job position ($\boldsymbol{n = 10}$). Source: Data repository on SurveyMonkey.

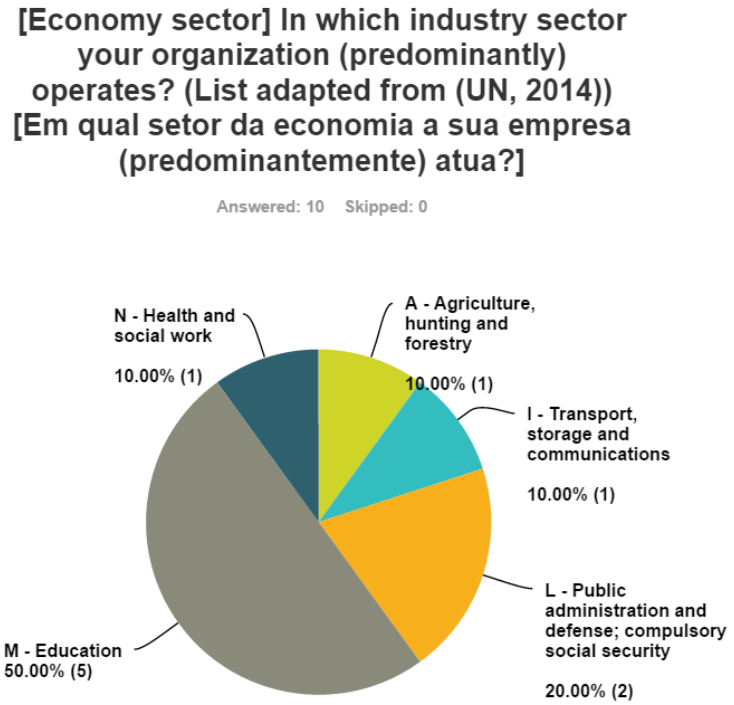

Figure VI.4 – Survey Pilot: organization economy sector ($\boldsymbol{n = 10}$). Source: Data repository on SurveyMonkey.

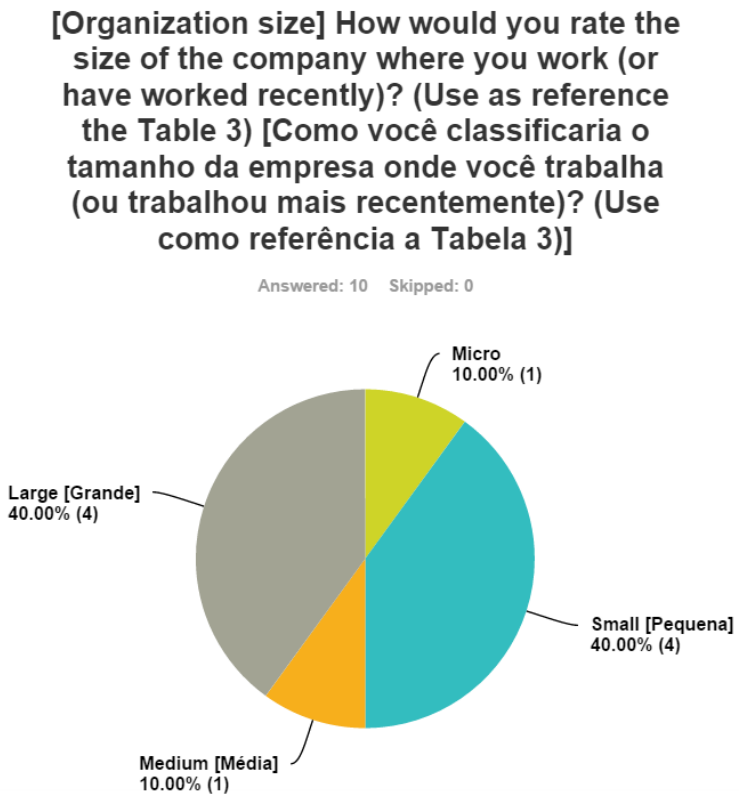

Figure VI.5 – Survey Pilot: respondents organization size ($\boldsymbol{n = 10}$). Source: Data repository on SurveyMonkey.

APPENDIX VI.2. Survey: Protocol

Investigators

Principal investigators:
Dr. Hermano Perrelli de Moura, Professor
Computer Centre (CIn), Federal University of Pernambuco (UFPE), Recife, Brazil.
Dr. Philippe Kruchten, P. Eng., Professor
Department of Electrical and Computer Engineering (ECE), The University of British Columbia (UBC), Vancouver, Canada.
Co-investigator:
Alexandre José Henrique de Oliveira Luna, student at UFPE/ CIn, pursuing a Doctoral degree in Computer Science.

Overview

The Agile Governance Cell (AGC) of the Project Research Group (GP2) in the Computer Centre (CIn) at Federal University of Pernambuco (UFPE) is conducting a research to get a better understanding of the relevance of the Agile Governance topic.

In fact, this study is part of a wider research conducted by the investigators in order to identify application of agile capabilities on governance capabilities to improve business operations, as well as the expand the understanding of how these arrangements can help the organizations to attain greater enterprise agility and support its overall strategy.

We are inviting representative agents from the phenomena in study to participate in an online survey seeking to investigate the application of agile capabilities on governance capabilities, their moderator factors and the eventual influence of environmental factors. This study will require the fulfillment of an online questionnaire by the internet.

Purpose

The purpose of the study is to collect data about the characteristics of agility dimension upon governance capabilities of the organizations and their projects, to assess a representative model derived from a theory of how they are influenced by the variables from the external environment and by the moderator effect of the variables from the inner context, and which are the effects upon business operations.

We are specifically interested in understanding the factors that influence "team performance", and other organizational contexts derived from its arrangements, namely: projects, business units, enterprise, and multi-organizational settings. Our intent is to use the knowledge gained during this study to develop guidelines that can be used by the industry for improve the performance of the organizations and its projects.

Respondent profile

We are inviting individuals with **professional or academic experience compatible with the sample profile designed for this study depicted in** Table VI.1. Due the fact of agile governance has been considered a nascent field of study (Luna et al., 2014b), it is a real challenge find experts on that topic.

After conduct a systematic literature review about the state of the art of agile governance (Luna et al., 2014b) and debate its findings with scholars and practitioners, we have agreed that the respondents that match with the profile depicted in Table VI.1**,** can be considered representative agents of the phenomena in study, possessing expertise that is relevant to this research.

Table VI.1– Sample profile

Criterion	Description
(1) Qualification	researchers/scholars, professionals or graduate students
(2) Experience	who has experience (academic and/ or professional) in: (c) **governance capabilities**: ability to develop competencies related to way as an organizational context is conducted, administered or controlled, i.e., strategic alignment, decision making, control, compliance ability, steering skills, policy making, accountability, etc. (d) **agile capabilities** (agile or lean methods): ability to develop competencies related to principles, values and practices, from agile and lean philosophy, i.e., flexibility, "doing more with less", agility, adaptability, resilience, responsiveness, "coordinability" or "orchestrability", self-organization, simplicity, readiness, etc.
(3) Context of action	In the context of leadership, coordination, management or steering
(4) Organizational context	In any of these organizational contexts: teams, projects, business units, entire enterprise, or multi-organizational setting.

Study procedure

This is an online survey comprehending the following question profile:

Table VI.2 – Questionnaire profile

Question profile	Questions	%
Questions about the positioning of the subject mindset	4	10%
Questions about constructs and their relations	24	59%
Questions related to respondent and his or her demography	8	19%

Question profile	Questions	%
Questions related to Survey analysis	5	12%
	41	100%

Relevant points to **keep in mind before start** to answer the questionnaire:

(a) This questionnaire must be answered **only** by individuals who match with the profile depicted in Table VI.1.

(b) This questionnaire takes, approximately, **30 minutes** to be answered completely.
   a. However, if you prefer, you can start the survey, stop it temporarily (keeping your answers safe) and resume it at your convenience until you finish it.

(c) We kindly ask you to answer the questionnaire **completely**. Otherwise, we will have to discard it, since incomplete questionnaires are not considered valid for our study.
   a. In case you do not feel comfortable in terms of knowledge to answer precisely any of the questions, please, do not leave unanswered.
   b. Feel comfortable in providing approximate answers.
   c. For the research is more important an approximate answer that no response.

(d) The respondent must keep in mind only a unique organizational context (at a time) when you are answering the questionnaire, based on your experience. You will choose it at the second question (Q2).
   a. If, at the second question (Q2), the respondent feels comfortable to answer the questionnaire in more than one organizational context, please, he or she should report this on the third question (Q3) that we will send another invitation to your email address, for further contribution.

(e) The questions from Q5 to Q28 are STATEMENTS. The answer should be the level of agreement with the situations introduced by each issue (according to the scale depicted in Table VI.3), based on the respondent's own experience in the organizational context chosen at the second question (Q2).

Table VI.3 - Assessment scale

Criteria	Assessment scale									
Illustrative Legend	☹ Strongly Disagree		☹ Disagree partially		😐 Indifferent		☺ Agree partially		☺ Strongly Agree	
Numeric Scale	1	2	3	4	5	6	7	8	9	10
Your answer: What is your level of agreement with the STATEMENT of the question?	I very strongly disagree	I strongly disagree	I very disagree	I disagree	I almost disagree	I almost agree	I agree	I very agree	I strongly agree	I very strongly agree

Confidentiality

No one other than the named investigators will have access to the verbatim data collected by this instrument. The study outcome shall be presented as a summary of gathered data, but no personally identifying information shall be reported.

Benefit

The participant will receive the following intangible benefits from participating in this study:

- The summary of the results will be shared to the participants that fill their email in the related question (Q40). This information may be useful for improve the performance of their organizations and their projects.
- Goodwill from participating in a study to investigate the application of agile capabilities on governance capabilities, their moderator factors and the eventual influence of environmental factors.

Contact for information about the study

If you have any concerns or desire further information with respect to this study, you may contact the co-investigator, Alexandre Luna (ajhol@cin.ufpe.br).

Contact for concerns about the rights of research subjects

If you have any concerns about your treatment or rights as a research subject, you may contact the Secretary of the Executive Board of Research (SEC-DPQ) in the UFPE Office for Research Affairs and Graduate Studies (PROPESQ) at +55 (81) 2126 7041 or dpq.propesq@ufpe.br.

Consent

Your participation in this study is entirely voluntary and you may refuse to participate or withdraw your data from the study at any time, before the completion of the questionnaire. Clicking in the link of the questionnaire indicates your consent and support for this study on behalf of your organization and your organization's permission for the use of the provided data to the aims of this study.

Questionnaire link

Individuals will be invited by email, according to their profile analysis against the criteria depicted in Table VI.1. The link that will be sent is uniquely tied to this survey and each email address.

Please do not forward the message received. If you want to suggest someone who has the required profile to participate in this survey, please send us an email with the contact details of this person, minimally consisting of: (1) Email; (2) First Name; (3) Surname; (4) Organization; (5) URL of professional profile (LinkedIn, CV, etc.). Then, we will evaluate the profile and, after that, we might send a personal invitation to email address of this person.

References and Acknowledges

We are very grateful to Steve Adolph (Adolph, 2013) by the inspiration to adapt his protocols to our own context.

This protocol was elaborated based on the following references: (Adolph, 2013; Creswell, 2003; Freitas et al., 2000; Gil, 2009; Groves et al., 2013; Pinsonneault and Kraemer, 1993)

The questionnaire was elaborated based on the further references: (Field, 2003; Lumsden, 2007; Marconi and Lakatos, 2003; Marôco, 2014)

APPENDIX VI.3. Survey: Questionnaire

Survey for assessing a representative model of the Agile Governance

1. Language | Idioma

***1. [Language] Which language do you prefer use to answer this survey?**

[Idioma] Que idioma prefere usar para responder a esta pesquisa?

- ◯ English
- ◯ Português

2. Boas-vindas e consentimento

O objetivo deste questionário é coletar dados sobre as características da dimensão de agilidade relacionadas às capacidades de governança das organizações e seus projetos.

A pesquisa tem fins exclusivamente acadêmicos, como parte das investigações relacionadas a uma tese de doutoramento do Programa de Pós-graduação em Ciência da Computação da Universidade Federal de Pernambuco (CIn-UFPE). Esta pesquisa está sendo conduzida pela Célula de Governança Ágil (CGA) do Grupo de Pesquisa em Projetos (GP2) no Centro de Informática (CIn) da Universidade Federal de Pernambuco (UFPE).

A identidade do respondente será absolutamente preservada. Maiores detalhes, considerando aspectos, como: objetivo, procedimento, confidencialidade, benefícios, ética e contatos; estão disponíveis no protocolo da pesquisa que pode ser acessado no link a seguir: http://www.agilegovernance.org/survey-protocol

Ao prosseguir, solicitamos gentilmente que:

(1) Você tenha em mente apenas um **único contexto organizacional** (por vez) quando você estiver respondendo o questionário, focando em sua experiência. Você o escolherá na **segunda questão (Q2)**.
(2) Se na **segunda questão (Q2)** você se sentir confortável para responder a este questionário em mais de um contexto organizacional, nos informe isso na **terceira questão (Q3)** que mandaremos um outro convite para seu endereço de email, para uma participação complementar.
(3) As questões de Q5 a Q28 são AFIRMAÇÕES. Sua resposta deve ser o grau de concordância com as situações introduzidas por cada questão, com base em sua própria experiência no contexto organizacional escolhido na segunda questão (Q2).
(4) Caso não se sinta à vontade em termos de conhecimento para responder alguma das questões de forma precisa, por favor, não deixe sem resposta. Sinta-se confortável em fornecer respostas aproximadas. Para a pesquisa é mais importante uma resposta aproximada que nenhuma resposta.

Clicando no botão "Próx." indica o seu consentimento para participar do estudo.

Obrigado pela sua colaboração!

3. Welcome and consent

Survey for assessing a representative model of the Agile Governance

The objective of this questionnaire is to collect data about the characteristics of agility dimension upon governance capabilities of the organizations and their projects.

The research has exclusively academic purposes as part of the investigation related to a doctoral thesis of the Graduate Program in Computer Science from the Federal University of Pernambuco (CIn-UFPE). This research is being carried out by the Agile Governance Cell (AGC) of the Project Research Group (GP2) in Informatics Centre (CIn) at Federal University of Pernambuco (UFPE).

The identity of the respondent will be absolutely preserved. Details, considering aspects such as: purpose, procedure, confidentiality, benefits, ethics and contacts; are available in the research protocol that can be accessed at the following link: http://www.agilegovernance.org/survey-protocol

By continuing, we ask gently that:

(1) You must keep in mind only a **unique organizational context** (at a time) when you are answering this questionnaire, based on your experience. You will choose it at the **second question (Q2)**.
(2) If, at the **second question (Q2)**, you feel comfortable to answer the questionnaire in more than one organizational context, please, you should report this on the **third question (Q3)** that we will send another invitation to your email address, for further contribution.
(3) The questions from Q5 to Q28 are STATEMENTS. Your answer should be the level of agreement with the situations introduced by each issue, based on your own experience in the organizational context chosen at the second question (Q2).
(4) In case you do not feel comfortable in terms of knowledge to answer precisely any of the questions, please, do not leave unanswered. Feel comfortable in providing approximate answers. For the research is more important an approximate answer that no response.

Clicking in the button "Next" indicates your consent to participate in this study.

Thank you for your cooperation!

4. Getting started... | Começando...

Instructions: At this initial stage you must: (1) Choose ONE organizational context to respond this questionnaire, based on the organization where you work (or you have worked), in the projects in which you take part (or you have took part), or on the context of your academic and professional experience; and, (2) Classify the organizational context chosen in a scale from chaos to order.
IMPORTANT: Whenever you wish, you can use the comments field of each question to add your own considerations (examples, criticisms or doubts) that could enrich the issues raised by them.
***Instruções**: Nesta fase inicial, você deve: (1) Escolher um contexto organizacional para responder este questionário, baseado na organização em que você trabalha (ou já trabalhou), nos projetos em que participa (ou você já participou), ou no contexto de sua experiência acadêmica e profissional; e, (2) Classificar o contexto organizacional escolhido em uma escala do caos à ordem.*
IMPORTANTE: Sempre que desejar, você pode usar o campo de comentários (Comments) de cada questão para adicionar suas próprias considerações (exemplos, críticas ou dúvidas) que possam enriquecer os pontos levantados por elas

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Glossary

Termos e significados

- **Organizational context:** is the environment comprised by the influence of social, economic, cultural, technological and political aspects related to positions and roles on individuals of a group, and refers to the scope of an institution; insofar it can be, in increasing order of complexity: team, project, business unit, enterprise, or a multi organizational setting.
  Contexto organizacional: é o ambiente composto pela influência de aspectos sociais, econômicos, culturais, tecnológicos e políticos relacionados com posições e papéis dos indivíduos de um grupo, e refere-se ao âmbito de uma instituição; na medida em que ele pode ser, em ordem crescente de complexidade: equipe, projeto, unidade de negócios da empresa, ou uma configuração multi organizacional.

Survey for assessing a representative model of the Agile Governance

***2. [Organizational context] Which of these organizational contexts best characterizes the background experience you will use to answer the questions of this survey? IMPORTANT: If you can contribute in more than one context, please, also answer the *next question*.**

[Contexto organizacional] Qual desses contextos organizacionais melhor caracteriza a experiência de fundo que você irá utilizar para responder as perguntas desta pesquisa? IMPORTANTE: Se você pode contribuir em mais de um contexto, por favor, responda também a próxima pergunta.

- ◯ TEAMWORK: My teamwork experience
  Minha experiência trabalhando em equipe
- ◯ PROJECT: My experience of participation in projects
  Minha experiência de participação em projetos
- ◯ BUSINESS UNIT: My experience working in sectors (business units) of the organization
  Minha experiência de trabalho em setores (unidades de negócio) da organização
- ◯ ENTERPRISE: My experience working having an overall view of the entire organization operating
  Minha experiência de trabalho tendo uma visão geral do funcionamento da organização inteira
- ◯ MULTI ORGANIZATIONAL: My experience working in a multi organizational setting
  Minha experiência de trabalho em ambiente de multi organizacional

Comments

3. [Other(s) Organizational context(s)] If you feel able to respond this questionnaire in more than one organizational context, please mark below which are they and we will send other invitation to your email address. IMPORTANT: We must ensure that you having in mind only one organizational context (at a time) when you are responding this questionnaire.

[Outro(s) Contexto(s) organizacional(is)] Se você se sentir apto a responder este questionário em mais de um contexto organizacional, por favor, marque abaixo quais são eles e nós lhe enviaremos outro convite para seu endereço de e-mail. IMPORTANTE: Temos de garantir que você tenha em mente apenas um contexto organizacional (por vez) quando você estiver respondendo o questionário.

- [ ] TEAMWORK: My teamwork experience
  Minha experiência trabalhando em equipe
- [ ] PROJECT: My experience of participation in projects
  Minha experiência de participação em projetos
- [ ] BUSINESS UNIT: My experience working in sectors (business units) of the organization
  Minha experiência de trabalho em setores (unidades de negócio) da organização
- [ ] ENTERPRISE: My experience working having an overall view of the entire organization operating
  Minha experiência de trabalho tendo uma visão geral do funcionamento da organização inteira
- [ ] MULTI ORGANIZATIONAL: My experience working in a multi organizational setting
  Minha experiência de trabalho em ambiente de multi organizacional

Comments

Survey for assessing a representative model of the Agile Governance

Illustrative Legend: Chaos and Order (for Question 4)

Legenda Ilustrativa: Caos e Ordem (para Questão 4)

Criteria	Assessment scale							
Illustrative Legend	 Chamos: destructive chaos		 Chaos		 Chaordic: a mix of chaos and order		 Order	
Numeric Scale	1	2	3	4	5	6	7	8
Your answer: how do you better characterize the chosen organizational context (our analysis unit) regarding to chaos and order?	Collapsing disorder and confusion	Destructive disorder and confusion	Complete disorder and confusion	Disorder and confusion	Blends more features of chaos than order	Blends more features of order than chaos	Procedures established	Adoption of best practices

Critérios	Escala de avaliação							
Legenda ilustrativa	 Chamos: caos destrutivo		 Caos		 Caórdico: um misto de caos e ordem		 Ordem	
Escala Numérica	1	2	3	4	5	6	7	8
Sua resposta: como você melhor caracterizar o contexto organizacional escolhido em relação ao caos e à ordem?	Desordem e confusão que levam ao colapso	Desordem e confusão destrutivas	Completa desordem e confusão	Desordem e confusão	Combina mais recursos de caos do que de ordem	Combina mais recursos de ordem do que de caos	Procedi-mentos estabele-cidos	Adoção de melhores práticas

***4. [Chaos & Order] Based on the referential established on question 2 (Q2), how do you better characterize the chosen organizational context in a scale from chaos to order?**

[Caos e Ordem] Com base no referencial estabelecido na pergunta 2 (Q2), como você melhor caracteriza o contexto organizacional escolhido numa escala de caos à ordem?

	1: Collapsing chaos *Caos colapsante*	2	3	4	5	6	7	8	9	10: Oppressive control *Controle opressivo*
Answer *Resposta*	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

Comments

5. Questions about effects of environmental factors (E)

Survey for assessing a representative model of the Agile Governance

The following questions are STATEMENTS. Your answer must be the level of agreement with the situations introduced by each question, based on your own experience in the organizational context chosen at the question 2 (Q2). The terms between brackets are key concepts (constructs) of this questionnaire.
IMPORTANT: Whenever you wish, you can use the comments field of each question to add your own considerations (examples, criticisms or doubts) that could enrich the issues raised by them.
As questões a seguir são AFIRMAÇÕES. Sua resposta deve ser o grau de concordância com as situações introduzidas por cada questão, com base em sua própria experiência no contexto organizacional escolhido na questão 2 (Q2). Os termos entre colchetes são os conceitos-chave (construtos) deste questionário.
IMPORTANTE: Sempre que desejar, você pode usar o campo de comentários (Comments) de cada questão para adicionar suas próprias considerações (exemplos, críticas ou dúvidas) que possam enriquecer os pontos levantados por elas.

Glossary

Termos e significados

- **Organizational context:** is the environment comprised by the influence of social, economic, cultural, technological and political aspects related to positions and roles on individuals of a group, and refers to the scope of an institution; insofar it can be, in increasing order of complexity: team, project, business unit, enterprise, or a multi organizational setting.
  Contexto organizacional: é o ambiente composto pela influência de aspectos sociais, econômicos, culturais, tecnológicos e políticos relacionados com posições e papéis dos indivíduos de um grupo, e refere-se ao âmbito de uma instituição; na medida em que ele pode ser, em ordem crescente de complexidade: equipe, projeto, unidade de negócios da empresa, ou uma configuração multi organizacional.
- **Business operations:** the set of organized activities involved in the day to day functions of the business, conducted for the purpose of generating value delivery, including (but not limited to): processes, functions, services, products, projects, practices, and behaviors. Those activities depends on the nature of the core business of the organization.
  Operações de negócio: o conjunto de atividades organizadas envolvidas no dia-a-dia das funções do negócio, conduzidas com o objetivo de gerar entrega de valor, incluindo (mas não limitadas a): processos, funções, serviços, produtos, projetos, práticas e comportamentos. Essas atividades dependem da natureza do core business da organização.
- **Core business:** is the *raison d'être* of any organization, the cause of its existence. For instance, in case of a company may be the target activity to achieve profit, for a NGO (Non-governmental organization) might be a variety of service and humanitarian functions, concerning to governments should be initiatives to accomplish the welfare of its citizens.
  Core business: é a razão de ser de qualquer organização, a causa de sua existência. Por exemplo, no caso de uma empresa pode ser a atividade alvo para atingir o lucro, para uma ONG (Organização não governamental) pode ser uma variedade de funções de serviço e humanitários, com respeito à governos devem ser iniciativas para alcançar o bem-estar dos seus cidadãos.
- **Effects of environmental factors:** are the effects sensed by the organizational context, as a result of the influence caused by the external environment in which the organizational context resides.
  Efeitos dos fatores ambientais: são os efeitos sentidos pelo contexto organizacional, como um resultado da influência causada pelo ambiente externo no qual o contexto organizacional reside.

Survey for assessing a representative model of the Agile Governance

Assessment scale (for every question)

Escala de Avaliação (para todas as questões)

Criteria	Assessment scale							
Illustrative Legend	Strongly Disagree		Disagree partially		Indifferent		Agree partially	
Numeric Scale	1	2	3	4	5	6	7	8
Your answer: What is your level of agreement with the STATEMENT of the question?	I very strongly disagree	I strongly disagree	I very disagree	I disagree	I almost disagree	I almost agree	I agree	I very agree

Critérios	Escala de avaliação							
Legenda ilustrativa	Discordo fortemente		Discordo parcialmente		Indiferente		Concordo parcialmente	
Escala Numérica	1	2	3	4	5	6	7	8
Sua resposta: Qual o seu nível de concordância com a AFIRMAÇÃO da questão?	Eu discordo muito fortemente	Eu discordo fortemente	Eu discordo muito	Eu discordo	Eu quase discordo	Eu quase concordo	Eu concordo	Eu concordo muito

***5. [Technological impact] You have experienced changes (or other disturbances) on the business operations due to the occurrence of technological impact in the environment where the organizational context was inserted (e.g., technological obsolescence, changing technological paradigm, etc.).**

[Impacto tecnológico] Você já vivenciou mudanças (ou outras perturbações) sobre as operações de negócio, devido à ocorrência de impacto tecnológico no ambiente onde o contexto organizacional estava inserido (e.g., obsolescência tecnológica, mudança de paradigma tecnológico, etc.).

	1: Very strongly disagree *Discordo muito fortemente*	2	3	4	5	6	7	8	9	10: Very strongly agree *Concordo muito fortemente*
Answer *Resposta*	○	○	○	○	○	○	○	○	○	○

Comments

***6. [Regulatory Institutions] You have experienced changes (or other disturbances) on the business operations due the influence of regulatory institutions from the environment where the organizational context was inserted (e.g., government, supervisory bodies, audit, etc.).**

[Instituições regulatórias] Você já vivenciou mudanças (ou outras perturbações) nas operações de negócio, devido à influência de instituições reguladoras do ambiente onde o contexto organizacional estava inserido (e.g., governo, órgãos de fiscalização, auditoria, etc.).

	1: Very strongly disagree *Discordo muito fortemente*	2	3	4	5	6	7	8	9	10: Very strongly agree *Concordo muito fortemente*
Answer *Resposta*	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

Comments

***7. [Competitiveness] You have experienced changes (or other disturbances) on the business operations due the influence of competitors from the environment where the organizational context was inserted (e.g., due competition for budget/investment against other projects/business units/enterprises, it being affected by the launching of a competitor product/service, etc.)**

[Competitividade] Você já vivenciou mudanças (ou outras perturbações) sobre as operações de negócio, devido à influência de concorrentes do ambiente onde o contexto organizacional estava inserido (e.g., devido à competição por orçamento/investimento com outros projetos/setores/empresas, sendo afetado pelo lançamento de um produto/serviço concorrente, etc.).

	1: Very strongly disagree *Discordo muito fortemente*	2	3	4	5	6	7	8	9	10: Very strongly agree *Concordo muito fortemente*
Answer *Resposta*	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

Comments

***8. [Economic influence] You have experienced changes (or other disturbances) on the business operations due the economic influence upon the environment where the organizational context was inserted (e.g., late payment, delay in release of funds, exchange, inflation, etc.).**

[Influência econômica] Você já vivenciou mudanças (ou outras perturbações) sobre as operações de negócio, devido à influência econômica no ambiente onde o contexto organizacional estava inserido (e.g., atraso de pagamento, demora na liberação de recursos, câmbio, inflação, etc.).

	1: Very strongly disagree *Discordo muito fortemente*	2	3	4	5	6	7	8	9	10: Very strongly agree *Concordo muito fortemente*
Answer *Resposta*	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

Comments

***9. [Market turbulence] You have experienced changes (or other disturbances) on the business operations due the turbulence of the environment where the organizational context was inserted (e.g., business requirements volatility, customer needs, globalization, etc.).**

[Turbulência do mercado] Você já vivenciou mudanças (ou outras perturbações) nas operações de negócio, devido à turbulência do ambiente em que o contexto organizacional estava inserido (e.g., volatilidade dos requisitos de negócio, as necessidades do cliente, globalização, etc.).

	1: Very strongly disagree *Discordo muito fortemente*	2	3	4	5	6	7	8	9	10: Very strongly agree *Concordo muito fortemente*
Answer *Resposta*	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

Comments

6. Questions about effects of moderator factors (M)

Survey for assessing a representative model of the Agile Governance

The following questions are STATEMENTS. Your answer must be the level of agreement with the situations introduced by each question, based on your own experience in the organizational context chosen at the question 2 (Q2). The terms between brackets are key concepts (constructs) of this questionnaire.
IMPORTANT: Whenever you wish, you can use the comments field of each question to add your own considerations (examples, criticisms or doubts) that could enrich the issues raised by them.
As questões a seguir são AFIRMAÇÕES. Sua resposta deve ser o grau de concordância com as situações introduzidas por cada questão, com base em sua própria experiência no contexto organizacional escolhido na questão 2 (Q2). Os termos entre colchetes são os conceitos-chave (construtos) deste questionário.
IMPORTANTE: Sempre que desejar, você pode usar o campo de comentários (Comments) de cada questão para adicionar suas próprias considerações (exemplos, críticas ou dúvidas) que possam enriquecer os pontos levantados por elas.

Glossary

Termos e significados

- **Organizational context:** is the environment comprised by the influence of social, economic, cultural, technological and political aspects related to positions and roles on individuals of a group, and refers to the scope of an institution; insofar it can be, in increasing order of complexity: team, project, business unit, enterprise, or a multi organizational setting.
  Contexto organizacional: é o ambiente composto pela influência de aspectos sociais, econômicos, culturais, tecnológicos e políticos relacionados com posições e papéis dos indivíduos de um grupo, e refere-se ao âmbito de uma instituição; na medida em que ele pode ser, em ordem crescente de complexidade: equipe, projeto, unidade de negócios da empresa, ou uma configuração multi organizacional.
- **Business operations:** is the set of organized activities involved in the day to day functions of the business, conducted for the purpose of generating value delivery, including (but not limited to): processes, functions, services, products, projects, practices, and behaviors. Those activities depends on the nature of the core business of the organization.
  Operações de negócio: é o conjunto de atividades organizadas envolvidas no dia-a-dia das funções do negócio, conduzidas com o objetivo de gerar entrega de valor, incluindo (mas não limitadas a): processos, funções, serviços, produtos, projetos, práticas e comportamentos. Essas atividades dependem da natureza do core business da organização.
- **Core business:** is the *raison d'être* of any organization, the cause of its existence. For instance, in case of a company may be the target activity to achieve profit, for a NGO (Non-governmental organization) might be a variety of service and humanitarian functions, concerning to governments should be initiatives to accomplish the welfare of its citizens.
  Core business: é a razão de ser de qualquer organização, a causa de sua existência. Por exemplo, no caso de uma empresa pode ser a atividade alvo para atingir o lucro, para uma ONG (Organização não governamental) pode ser uma variedade de funções de serviço e humanitários, com respeito à governos devem ser iniciativas para alcançar o bem-estar dos seus cidadãos.
- **Effects of moderator factors:** are the effects sensed by the organizational context as a result of the influence caused by factors that tend mediate, inhibit or restraining the organizational performance. The nature of these factors varies according to the particularity of each organizational context.
  Efeitos dos fatores moderadores: são os efeitos sentidos pelo contexto organizacional como um resultado da influência causada por fatores que tendem mediar, inibir ou imobilizar o desempenho organizacional. A natureza destes fatores varia de acordo com a particularidade de cada contexto organizacional.

Survey for assessing a representative model of the Agile Governance

Assessment scale (for every question)

Escala de Avaliação (para todas as questões)

Criteria	Assessment scale							
Illustrative Legend	Strongly Disagree		Disagree partially		Indifferent		Agree partially	
Numeric Scale	1	2	3	4	5	6	7	8
Your answer: What is your level of agreement with the STATEMENT of the question?	I very strongly disagree	I strongly disagree	I very disagree	I disagree	I almost disagree	I almost agree	I agree	I very agree

Critérios	Escala de avaliação							
Legenda ilustrativa	Discordo fortemente		Discordo parcialmente		Indiferente		Concordo parcialmente	
Escala Numérica	1	2	3	4	5	6	7	8
Sua resposta: Qual o seu nível de concordância com a AFIRMAÇÃO da questão?	Eu discordo muito fortemente	Eu discordo fortemente	Eu discordo muito	Eu discordo	Eu quase discordo	Eu quase concordo	Eu concordo	Eu concordo muito

***10. [Organizational Culture] You have experienced restraint or inhibition (or other limiting effects) on the business operations due the influence of organizational culture (e.g., refractory behavior, lack of team cohesion, etc.).**

[Cultura organizacional] Você já vivenciou restrição ou inibição (ou outros efeitos limitantes) sobre as operações de negócios, devido a influência da cultura organizacional (e.g., comportamento refratário, a falta de coesão da equipe, etc.).

	1: Very strongly disagree *Discordo muito fortemente*	2	3	4	5	6	7	8	9	10: Very strongly agree *Concordo muito fortemente*
Answer *Resposta*	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

Comments

***11. [Leadership] You have experienced restraint or inhibition (or other limiting effects) on the business operations due the influence of issues related to leadership (e.g., inadequacy of leadership style, lack of leadership, etc.).**

[Liderança] Você já vivenciou restrição ou inibição (ou outros efeitos limitantes) sobre as operações de negócios, devido à influência de questões relacionadas à liderança (e.g., inadequação do estilo de liderança, ausência de liderança, etc.).

	1: Very strongly disagree *Discordo muito fortemente*	2	3	4	5	6	7	8	9	10: Very strongly agree *Concordo muito fortemente*
Answer *Resposta*	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

Comments

***12. [Enterprise architecture] You have experienced restraint or inhibition (or other limiting effects) on the business operations due the influence of inadequacy of the enterprise architecture (e.g., organizational structure, lack of infrastructure scalability/modularity, operation centralization/decentralization, etc.).**

[Arquitetura empresarial] Você já vivenciou restrição ou inibição (ou outros efeitos limitantes) sobre as operações de negócios, devido à influência da inadequação da arquitetura empresarial (e.g., estrutura organizacional, falta de escalabilidade/modularidade na infraestrutura, centralização/descentralização da operação, etc.).

	1: Very strongly disagree *Discordo muito fortemente*	2	3	4	5	6	7	8	9	10: Very strongly agree *Concordo muito fortemente*
Answer *Resposta*	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

Comments

***13. [Business model] You have experienced restraint or inhibition (or other limiting effects) on the business operations due the influence of the inadequacy of how business is structured to create, deliver, and capture value (e.g., strategic shortcoming, operational discrepancy, etc.).**

[Modelo de negócio] Você já vivenciou restrição ou inibição (ou outros efeitos limitantes) sobre as operações de negócios, devido à influência da inadequação de como o negócio está estruturado para criar, entregar e capturar valor (e.g., deficiência estratégica, discrepância operacional, etc.).

	1: Very strongly disagree *Discordo muito fortemente*	2	3	4	5	6	7	8	9	10: Very strongly agree *Concordo muito fortemente*
Answer *Resposta*	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

Comments

***14. [People qualification] You have experienced restraint or inhibition (or other limiting effects) on the business operations due the influence of lack of people qualification (e.g., education, skills, etc.).**

[Qualificação das pessoas] Você já vivenciou restrição ou inibição (ou outros efeitos limitantes) sobre as operações de negócios, devido à influência da falta de qualificação das pessoas (e.g., educação, habilidades, etc.).

	1: Very strongly disagree *Discordo muito fortemente*	2	3	4	5	6	7	8	9	10: Very strongly agree *Concordo muito fortemente*
Answer *Resposta*	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

Comments

7. Questions about agile capabilities (A)

Survey for assessing a representative model of the Agile Governance

The following questions are STATEMENTS. Your answer must be the level of agreement with the situations introduced by each question, based on your own experience in the organizational context chosen at the question 2 (Q2). The terms between brackets are key concepts (constructs) of this questionnaire.
IMPORTANT: Whenever you wish, you can use the comments field of each question to add your own considerations (examples, criticisms or doubts) that could enrich the issues raised by them.
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IMPORTANTE: Sempre que desejar, você pode usar o campo de comentários (Comments) de cada questão para adicionar suas próprias considerações (exemplos, críticas ou dúvidas) que possam enriquecer os pontos levantados por elas.

Glossary

Termos e significados

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  Contexto organizacional: é o ambiente composto pela influência de aspectos sociais, econômicos, culturais, tecnológicos e políticos relacionados com posições e papéis dos indivíduos de um grupo, e refere-se ao âmbito de uma instituição; na medida em que ele pode ser, em ordem crescente de complexidade: equipe, projeto, unidade de negócios da empresa, ou uma configuração multi organizacional.
- **Business operations:** is the set of organized activities involved in the day to day functions of the business, conducted for the purpose of generating value delivery, including (but not limited to): processes, functions, services, products, projects, practices, and behaviors. Those activities depends on the nature of the core business of the organization.
  Operações de negócio: é o conjunto de atividades organizadas envolvidas no dia-a-dia das funções do negócio, conduzidas com o objetivo de gerar entrega de valor, incluindo (mas não limitadas a): processos, funções, serviços, produtos, projetos, práticas e comportamentos. Essas atividades dependem da natureza do core business da organização.
- **Core business:** is the *raison d'être* of any organization, the cause of its existence. For instance, in case of a company may be the target activity to achieve profit, for a NGO (Non-governmental organization) might be a variety of service and humanitarian functions, concerning to governments should be initiatives to accomplish the welfare of its citizens.
  Core business: é a razão de ser de qualquer organização, a causa de sua existência. Por exemplo, no caso de uma empresa pode ser a atividade alvo para atingir o lucro, para uma ONG (Organização não governamental) pode ser uma variedade de funções de serviço e humanitários, com respeito à governos devem ser iniciativas para alcançar o bem-estar dos seus cidadãos.
- **Agile capabilities:** is the ability to acquire, develop, apply and evolve competencies related to principles, values and practices, from agile and lean philosophies on organizational context.
  Capacidades ágeis: é a capacidade de adquirir, desenvolver, aplicar e evoluir competências relacionadas com princípios, valores e práticas, da filosofias ágil e *lean* no contexto organizacional.

Survey for assessing a representative model of the Agile Governance

Assessment scale (for every question)

Escala de Avaliação (para todas as questões)

Criteria	Assessment scale							
Illustrative Legend	Strongly Disagree		Disagree partially		Indifferent		Agree partially	
Numeric Scale	1	2	3	4	5	6	7	8
Your answer: What is your level of agreement with the STATEMENT of the question?	I very strongly disagree	I strongly disagree	I very disagree	I disagree	I almost disagree	I almost agree	I agree	I very agree

Critérios	Escala de avaliação							
Legenda ilustrativa	Discordo fortemente		Discordo parcialmente		Indiferente		Concordo parcialmente	
Escala Numérica	1	2	3	4	5	6	7	8
Sua resposta: Qual o seu nível de concordância com a AFIRMAÇÃO da questão?	Eu discordo muito fortemente	Eu discordo fortemente	Eu discordo muito	Eu discordo	Eu quase discordo	Eu quase concordo	Eu concordo	Eu concordo muito

***15. [Flexibility] You have experienced circumstances where adjustment capability (adequacy) of business operations to handle with an unexpected situation (e.g., assimilating the change, having resilience to deal with it, etc.) was essential to ensure the performance of the organization and its projects.**

[Flexibilidade] Você já vivenciou situações onde a capacidade de ajuste (adequação) das operações de negócio para lidar com uma situação inesperada (e.g., assimilando a mudança, tendo resiliência para lidar com ela, etc.) foi determinante para garantir o desempenho da organização e seus projetos.

	1: Very strongly disagree *Discordo muito fortemente*	2	3	4	5	6	7	8	9	10: Very strongly agree *Concordo muito fortemente*
Answer *Resposta*	○	○	○	○	○	○	○	○	○	○

Comments

Survey for assessing a representative model of the Agile Governance

***16. [Leanness] You have experienced circumstances where the capability "to do more with less" on business operations (e.g., eliminating waste, keeping the things simple, reusing resources, etc.) was essential to ensure the performance of the organization and its projects.**

[Parcimônia] Você já vivenciou situações onde a capacidade de "fazer mais com menos" nas operações de negócios (e.g., eliminando o disperdício, mantendo as coisas simples, reutilizando recursos, etc.) foi essencial para garantir o desempenho da organização e de seus projetos.

	1: Very strongly disagree *Discordo muito fortemente*	2	3	4	5	6	7	8	9	10: Very strongly agree *Concordo muito fortemente*
Answer *Resposta*	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

Comments

***17. [Agility] You have experienced circumstances where the capability "to react to changes faster than the rate of these changes" on business operations (e.g., anticipating change when possible, analyzing and reacting quickly to it, etc.) was essential to ensure the performance of the organization and its projects.**

[Agilidade] Você já vivenciou situações onde a capacidade de "reagir às mudanças mais rápido do que a taxa dessas mudanças" nas operações de negócios (e.g., antecipando-se à mudança quando possível, analisando e reagindo rapidamente a ela, etc.) foi essencial para garantir o desempenho da organização e de seus projetos.

	1: Very strongly disagree *Discordo muito fortemente*	2	3	4	5	6	7	8	9	10: Very strongly agree *Concordo muito fortemente*
Answer *Resposta*	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

Comments

Survey for assessing a representative model of the Agile Governance

***18. [Adaptability] You have experienced circumstances where the capability "to adapt evolutionarily" on business operations (e.g., it adjusting in an evolutive manner, developing new strategic features, adjustability, etc.) was essential to ensure the performance of the organization and its projects.**

[Adaptabilidade] Você já vivenciou situações onde a capacidade de "adaptar evolutivamente" as operações de negócios (e.g., ajustando-as evolutivamente, desenvolvendo novas características estratégicas, etc.) foi essencial para garantir o desempenho da organização e de seus projetos.

	1: Very strongly disagree *Discordo muito fortemente*	2	3	4	5	6	7	8	9	10: Very strongly agree *Concordo muito fortemente*
Answer *Resposta*	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

Comments

8. Questions about governance capabilities (G)

The following questions are STATEMENTS. Your answer must be the level of agreement with the situations introduced by each question, based on your own experience in the organizational context chosen at the question 2 (Q2). The terms between brackets are key concepts (constructs) of this questionnaire.
IMPORTANT: Whenever you wish, you can use the comments field of each question to add your own considerations (examples, criticisms or doubts) that could enrich the issues raised by them.

As questões a seguir são AFIRMAÇÕES. Sua resposta deve ser o grau de concordância com as situações introduzidas por cada questão, com base em sua própria experiência no contexto organizacional escolhido na questão 2 (Q2). Os termos entre colchetes são os conceitos-chave (construtos) deste questionário.
IMPORTANTE: Sempre que desejar, você pode usar o campo de comentários (Comments) de cada questão para adicionar suas próprias considerações (exemplos, críticas ou dúvidas) que possam enriquecer os pontos levantados por elas.

Glossary

Termos e significados

- **Organizational context:** is the environment comprised by the influence of social, economic, cultural, technological and political aspects related to positions and roles on individuals of a group, and refers to the scope of an institution; insofar it can be, in increasing order of complexity: team, project, business unit, enterprise, or a multi organizational setting.
  Contexto organizacional: é o ambiente composto pela influência de aspectos sociais, econômicos, culturais, tecnológicos e políticos relacionados com posições e papéis dos indivíduos de um grupo, e refere-se ao âmbito de uma instituição; na medida em que ele pode ser, em ordem crescente de complexidade: equipe, projeto, unidade de negócios da empresa, ou uma configuração multi organizacional.
- **Business operations:** is the set of organized activities involved in the day to day functions of the business, conducted for the purpose of generating value delivery, including (but not limited to): processes, functions, services, products, projects, practices, and behaviors. Those activities depends on the nature of the core business of the organization.
  Operações de negócio: é o conjunto de atividades organizadas envolvidas no dia-a-dia das funções do negócio, conduzidas com o objetivo de gerar entrega de valor, incluindo (mas não limitadas a): processos, funções, serviços, produtos, projetos, práticas e comportamentos. Essas atividades dependem da natureza do core business da organização.
- **Core business:** is the *raison d'être* of any organization, the cause of its existence. For instance, in case of a company may be the target activity to achieve profit, for a NGO (Non-governmental organization) might be a variety of service and humanitarian functions, concerning to governments should be initiatives to accomplish the welfare of its citizens.
  Core business: é a razão de ser de qualquer organização, a causa de sua existência. Por exemplo, no caso de uma empresa pode ser a atividade alvo para atingir o lucro, para uma ONG (Organização não governamental) pode ser uma variedade de funções de serviço e humanitários, com respeito à governos devem ser iniciativas para alcançar o bem-estar dos seus cidadãos.
- **Governance capabilities:** is the ability to acquire, develop, apply and evolve competencies related to the way as an organizational context is conducted, administered or controlled, including the relationships between the distinct parties involved and the aims for which it is governed.
  Capacidades de governança: é a capacidade de adquirir, desenvolver, aplicar e evoluir competências relacionadas à maneira como um contexto organizacional é conduzido, administrado ou controlado, incluindo as relações entre as partes distintas envolvidas e os objetivos pelos os quais ele é governado.

Assessment scale (for every question)

Escala de Avaliação (para todas as questões)

Criteria	Assessment scale							
Illustrative Legend	☹ Strongly Disagree		☹ Disagree partially		😐 Indifferent		☺ Agree partially	
Numeric Scale	1	2	3	4	5	6	7	8
Your answer: What is your level of agreement with the STATEMENT of the question?	I very strongly disagree	I strongly disagree	I very disagree	I disagree	I almost disagree	I almost agree	I agree	I very agree

Critérios	Escala de avaliação							
Legenda ilustrativa	☹ Discordo fortemente		☹ Discordo parcialmente		😐 Indiferente		☺ Concordo parcialmente	
Escala Numérica	1	2	3	4	5	6	7	8
Sua resposta: Qual o seu nível de concordância com a AFIRMAÇÃO da questão?	Eu discordo muito fortemente	Eu discordo fortemente	Eu discordo muito	Eu discordo	Eu quase discordo	Eu quase concordo	Eu concordo	Eu concordo muito

***19. [Strategic alignment] You have experienced circumstances where the capability "to ensure a continuous strategic alignment" on business operations (e.g., keeping the operations in line with the business strategy, doing the right thing, prioritizing initiatives, etc.) was essential to guarantee the achievement of the objectives of the organization and its projects.**

[Alinhamento estratégico] Você já vivenciou situações onde a capacidade de "garantir um alinhamento estratégico contínuo" sobre as operações de negócios (e.g., mantendo as operações alinhadas com a estratégia de negócio, fazendo a coisa certa, priorizando iniciativas, etc.) foi essencial para garantir o alcance dos objetivos da organização e de seus projetos.

	1: Very strongly disagree *Discordo muito fortemente*	2	3	4	5	6	7	8	9	10: Very strongly agree *Concordo muito fortemente*
Answer *Resposta*	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

Comments

***20. [Decision making] You have experienced circumstances where the capability "to ensure effective decision making" on business operations (e.g., reducing more complicated decisions down to simpler steps, weighing up the risks involved, weighing up the pros and cons of each course of action, etc.) was essential to guarantee the achievement of the objectives of the organization and its projects.**

[Tomada de decisão] Você já vivenciou situações onde a capacidade de "garantir a tomada de decisão eficaz" sobre as operações de negócios (e.g., reduzindo as decisões mais complicadas em etapas mais simples, ponderando os riscos envolvidos, ponderando os prós e os contras de cada curso de ação, etc.) foi essencial para garantir o alcance dos objetivos da organização e de seus projetos.

	1: Very strongly disagree *Discordo muito fortemente*	2	3	4	5	6	7	8	9	10: Very strongly agree *Concordo muito fortemente*
Answer *Resposta*	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

Comments

***21. [Control] You have experienced circumstances where the capability "to ensure the strategy accomplishment" on business operations (e.g., establishing mechanism, policies, accountability, etc.) was essential to guarantee the achievement of the objectives of the organization and its projects.**

[Controle] Você já vivenciou situações onde a capacidade de "garantir o cumprimento da estratégia" nas operações de negócios (e.g., estabelecendo mecanismos, políticas, prestação de contas, etc.) foi essencial para garantir o alcance dos objetivos da organização e de seus projetos.

	1: Very strongly disagree *Discordo muito fortemente*	2	3	4	5	6	7	8	9	10: Very strongly agree *Concordo muito fortemente*
Answer *Resposta*	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

Comments

***22. [Compliance] You have experienced circumstances where the capability "to ensure regulatory compliance status" of business operations (e.g., complying with organizational policies, legislation, international standards, market rules, etc.) was essential to guarantee the achievement of the objectives of the organization and its projects.**

[Conformidade] Você já vivenciou situações onde a capacidade de "garantir o estado de conformidade regulatória" das operações de negócios (e.g., mantendo-se em conformidade com políticas organizacionais, legislação, normas internacionais, regras de mercado, etc.) foi essencial para garantir o alcance dos objetivos da organização e de seus projetos.

	1: Very strongly disagree *Discordo muito fortemente*	2	3	4	5	6	7	8	9	10: Very strongly agree *Concordo muito fortemente*
Answer *Resposta*	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

Comments

9. Questions about business operations (B)

Survey for assessing a representative model of the Agile Governance

The following questions are STATEMENTS. Your answer must be the level of agreement with the situations introduced by each question, based on your own experience in the organizational context chosen at the question 2 (Q2). The terms between brackets are key concepts (constructs) of this questionnaire.
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Glossary

Termos e significados

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- **Business operations:** is the set of organized activities involved in the day to day functions of the business, conducted for the purpose of generating value delivery, including (but not limited to): processes, functions, services, products, projects, practices, and behaviors. Those activities depends on the nature of the core business of the organization.
  Operações de negócio: é o conjunto de atividades organizadas envolvidas no dia-a-dia das funções do negócio, conduzidas com o objetivo de gerar entrega de valor, incluindo (mas não limitadas a): processos, funções, serviços, produtos, projetos, práticas e comportamentos. Essas atividades dependem da natureza do core business da organização.
- **Core business:** is the *raison d'être* of any organization, the cause of its existence. For instance, in case of a company may be the target activity to achieve profit, for a NGO (Non-governmental organization) might be a variety of service and humanitarian functions, concerning to governments should be initiatives to accomplish the welfare of its citizens.
  Core business: é a razão de ser de qualquer organização, a causa de sua existência. Por exemplo, no caso de uma empresa pode ser a atividade alvo para atingir o lucro, para uma ONG (Organização não governamental) pode ser uma variedade de funções de serviço e humanitários, com respeito à governos devem ser iniciativas para alcançar o bem-estar dos seus cidadãos.

Survey for assessing a representative model of the Agile Governance

Assessment scale (for every question)

Escala de Avaliação (para todas as questões)

Criteria	Assessment scale							
Illustrative Legend	☹ Strongly Disagree		☹ Disagree partially		😐 Indifferent		☺ Agree partially	
Numeric Scale	1	2	3	4	5	6	7	8
Your answer: What is your level of agreement with the STATEMENT of the question?	I very strongly disagree	I strongly disagree	I very disagree	I disagree	I almost disagree	I almost agree	I agree	I very agree

Critérios	Escala de avaliação							
Legenda ilustrativa	☹ Discordo fortemente		☹ Discordo parcialmente		😐 Indiferente		☺ Concordo parcialmente	
Escala Numérica	1	2	3	4	5	6	7	8
Sua resposta: Qual o seu nível de concordância com a AFIRMAÇÃO da questão?	Eu discordo muito fortemente	Eu discordo fortemente	Eu discordo muito	Eu discordo	Eu quase discordo	Eu quase concordo	Eu concordo	Eu concordo muito

***23. [Business process] You have experienced circumstances where the capability "to establish and implement business processes" to business operations (e.g., ensuring the reproducibility of business operations, supporting business goals, ensuring business continuity, etc.) was essential to guarantee the continuity of supply of products and/or services.**

[Processos de negócio] Você já vivenciou situações onde a capacidade de "estabelecer e implementar processos de negócios" para as operações de negócio (e.g., garantindo a reprodutibilidade das operações de negócio, apoiando as metas do negócio, garantindo a continuidade do negócio, etc.) foi essencial para garantir a continuidade do fornecimento de produtos e/ou serviços.

	1: Very strongly disagree *Discordo muito fortemente*	2	3	4	5	6	7	8	9	10: Very strongly agree *Concordo muito fortemente*
Answer *Resposta*	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

Comments

***24. [Projects] You have experienced circumstances where the capability "to establish and implement a project-based approach" for (*transitory aspects of*) business operations (e.g., dealing with service transition, applying to change management, to produce new product/service, etc.) was essential to guarantee the continuity of supply of products and/or services.**

[Projetos] Você já vivenciou situações onde a capacidade de "estabelecer e implementar uma abordagem baseada em projeto" para (aspectos transitórios das) operações de negócios (e.g., lidando com transição de serviço, aplicando no gerenciamento de mudanças, para a produção de novo produto/serviço, etc.) foi essencial para garantir a continuidade do fornecimento de produtos e/ou serviços.

	1: Very strongly disagree *Discordo muito fortemente*	2	3	4	5	6	7	8	9	10: Very strongly agree *Concordo muito fortemente*
Answer *Resposta*	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

Comments

***25. [Practices] You have experienced circumstances where the capability "to establish and implement best practices" on business operations (e.g., organizational learning, benchmarking, etc.) was essential to guarantee the continuity of supply of products and/or services.**

[Práticas] Você já vivenciou situações onde a capacidade de "estabelecer e implementar boas práticas" nas operações de negócio (e.g., aprendizagem organizacional, benchmarking, etc.) foi essencial para garantir a continuidade do fornecimento de produtos e/ou serviços.

	1: Very strongly disagree *Discordo muito fortemente*	2	3	4	5	6	7	8	9	10: Very strongly agree *Concordo muito fortemente*
Answer *Resposta*	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

Comments

10. Questions about value delivery (R)

Survey for assessing a representative model of the Agile Governance

The following questions are STATEMENTS. Your answer must be the level of agreement with the situations introduced by each question, based on your own experience in the organizational context chosen at the question 2 (Q2). The terms between brackets are key concepts (constructs) of this questionnaire.
IMPORTANT: Whenever you wish, you can use the comments field of each question to add your own considerations (examples, criticisms or doubts) that could enrich the issues raised by them.
As questões a seguir são AFIRMAÇÕES. Sua resposta deve ser o grau de concordância com as situações introduzidas por cada questão, com base em sua própria experiência no contexto organizacional escolhido na questão 2 (Q2). Os termos entre colchetes são os conceitos-chave (construtos) deste questionário.
IMPORTANTE: Sempre que desejar, você pode usar o campo de comentários (Comments) de cada questão para adicionar suas próprias considerações (exemplos, críticas ou dúvidas) que possam enriquecer os pontos levantados por elas.

Glossary

Termos e significados

- **Organizational context:** is the environment comprised by the influence of social, economic, cultural, technological and political aspects related to positions and roles on individuals of a group, and refers to the scope of an institution; insofar it can be, in increasing order of complexity: team, project, business unit, enterprise, or a multi organizational setting.
  Contexto organizacional: é o ambiente composto pela influência de aspectos sociais, econômicos, culturais, tecnológicos e políticos relacionados com posições e papéis dos indivíduos de um grupo, e refere-se ao âmbito de uma instituição; na medida em que ele pode ser, em ordem crescente de complexidade: equipe, projeto, unidade de negócios da empresa, ou uma configuração multi organizacional.
- **Business operations:** is the set of organized activities involved in the day to day functions of the business, conducted for the purpose of generating value delivery, including (but not limited to): processes, functions, services, products, projects, practices, and behaviors. Those activities depends on the nature of the core business of the organization.
  Operações de negócio: é o conjunto de atividades organizadas envolvidas no dia-a-dia das funções do negócio, conduzidas com o objetivo de gerar entrega de valor, incluindo (mas não limitadas a): processos, funções, serviços, produtos, projetos, práticas e comportamentos. Essas atividades dependem da natureza do core business da organização.
- **Core business:** is the *raison d'être* of any organization, the cause of its existence. For instance, in case of a company may be the target activity to achieve profit, for a NGO (Non-governmental organization) might be a variety of service and humanitarian functions, concerning to governments should be initiatives to accomplish the welfare of its citizens.
  Core business: é a razão de ser de qualquer organização, a causa de sua existência. Por exemplo, no caso de uma empresa pode ser a atividade alvo para atingir o lucro, para uma ONG (Organização não governamental) pode ser uma variedade de funções de serviço e humanitários, com respeito à governos devem ser iniciativas para alcançar o bem-estar dos seus cidadãos.
- **Value delivery:** is the ability to generate results (and become persistent the benefits arising from them) to the business by means of the delivery of value, whereas includes all forms of value that determine the health and well-being of the organization in the long run.
  Entrega de valor: é a capacidade de gerar resultados (e tornar persistente os benefícios deles decorrentes) para o negócio por meio da entrega de valor, incluindo todas as formas de valor que determinam a saúde e o bem-estar da organização a longo prazo.

Survey for assessing a representative model of the Agile Governance

Assessment scale (for every question)

Escala de Avaliação (para todas as questões)

Criteria	Assessment scale							
Illustrative Legend	Strongly Disagree		Disagree partially		Indifferent		Agree partially	
Numeric Scale	1	2	3	4	5	6	7	8
Your answer: What is your level of agreement with the STATEMENT of the question?	I very strongly disagree	I strongly disagree	I very disagree	I disagree	I almost disagree	I almost agree	I agree	I very agree

Critérios	Escala de avaliação							
Legenda ilustrativa	Discordo fortemente		Discordo parcialmente		Indiferente		Concordo parcialmente	
Escala Numérica	1	2	3	4	5	6	7	8
Sua resposta: Qual o seu nível de concordância com a AFIRMAÇÃO da questão?	Eu discordo muito fortemente	Eu discordo fortemente	Eu discordo muito	Eu discordo	Eu quase discordo	Eu quase concordo	Eu concordo	Eu concordo muito

***26. [Utility] You have experienced circumstances where the "embedding of utility concept for products or services" (e.g., making it fit for purpose, making it for meet the audience desire, etc.) led to increase value delivery (e.g., satisfaction, better acceptance, etc.) for target audience (customers, citizens, etc.).**

[Utilidade] Você já vivenciou circunstâncias em que a "incorporação do conceito de utilidade para produtos ou serviços" (e.g., fazendo-o apto para o propósito, fazendo-o atender ao anseio do público, etc.) acarretou o aumento da entrega de valor (e.g., satisfação, melhor aceitação, etc.) para o público-alvo (e.g., clientes, cidadãos, etc.).

	1: Very strongly disagree *Discordo muito fortemente*	2	3	4	5	6	7	8	9	10: Very strongly agree *Concordo muito fortemente*
Answer *Resposta*	○	○	○	○	○	○	○	○	○	○

Comments

***27. [Warranty] You have experienced circumstances where the "embedding of warranty concept for products or services" (e.g., making it fit for use, keeping it available for use, ensuring the required performance, etc.) led to increase value delivery (e.g., satisfaction, better acceptance, etc.) for target audience (customers, citizens, etc.).**

[Garantia] Você já vivenciou circunstâncias em que a "incorporação do conceito de garantia para produtos ou serviços" (e.g., fazendo-o apto para uso, mantendo-o disponível para o uso, garantindo o desempenho necessário, etc.) acarretou o aumento da entrega de valor (e.g., satisfação, melhor aceitação, etc.) para o público-alvo (e.g., clientes, cidadãos, etc.).

	1: Very strongly disagree *Discordo muito fortemente*	2	3	4	5	6	7	8	9	10: Very strongly agree *Concordo muito fortemente*
Answer *Resposta*	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

Comments

***28. [Time-to-market] You have experienced circumstances where the "development of mechanisms to reduce time-to-market of products or services" (e.g., quick release, continuous improvement, etc.) led to increase value delivery (e.g., satisfaction, better acceptance, etc.) for target audience (customers, citizens, etc.).**

[Time-to-market] Você já vivenciou circunstâncias em que o "desenvolvimento de mecanismos para reduzir o tempo de colocação de produtos ou serviços no mercado" (e.g., entrega rápida, melhoria contínua, etc.) acarretou o aumento da entrega de valor (e.g., satisfação, melhor aceitação, etc.) para o público-alvo (e.g., clientes, cidadãos, etc.).

	1: Very strongly disagree *Discordo muito fortemente*	2	3	4	5	6	7	8	9	10: Very strongly agree *Concordo muito fortemente*
Answer *Resposta*	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

Comments

11. Questions about you

Now, we would like to know more about your profile. This is very important for the analysis of your responses.

Survey for assessing a representative model of the Agile Governance

IMPORTANT: Whenever you wish, you can use the comments field of each question to add your own considerations (examples, criticisms or doubts) that could enrich the issues raised by them.
Agora, desejamos conhecer melhor o seu perfil. Isso será muito importante para análise de suas respostas. IMPORTANTE: Sempre que desejar, você pode usar o campo de comentários (Comments) de cada questão para adicionar suas próprias considerações (exemplos, críticas ou dúvidas) que possam enriquecer os pontos levantados por elas.

*29. [Work experience] How long is your work experience?

[Experiência profissional] Quantos anos de experiência profissional (total) você tem?

- ◯ Up to 1 year | *Até 1 ano*
- ◯ From 1 to 5 years | *De 1 a 5 anos*
- ◯ From 6 to 10 years | *De 6 a 10 anos*
- ◯ From 11 to 15 years | *De 11 a 15 anos*
- ◯ From 16 to 20 years | *De 16 a 20 anos*
- ◯ More than 20 years | *Mais de 20 anos*

Comments

*30. [Job position] What is your currently job position?

[Cargo] Qual o seu cargo atualmente?

- ☐ Business owner | *Empreendedor*
- ☐ CEO
- ☐ CIO
- ☐ Executive | *Executivo*
- ☐ Consultant | *Consultor*
- ☐ Professor
- ☐ Researcher | *Pesquisador*
- ☐ IT Professional | *Profissional de TI*
- ☐ Project Management | *Gerente de Projetos*
- ☐ Software Engineer | *Engenheiro de Software*
- ☐ System Analyst | *Analista de Sistemas*
- ☐ Agent of the Public Administration | *Agente público*
- ☐ Graduate student | *Estudante de Pós-graduação*

Other (please specify)

Survey for assessing a representative model of the Agile Governance

***31. [Education] What is your level of education (completed)?**

[Educação formal] Qual o seu nível de formação (concluído)?

- ◯ Graduate | *Superior completo*
- ◯ MBA (Lato Sensu) | *Especialização*
- ◯ Master degree | *Mestrado*
- ◯ PhD | *Doutorado*
- ◯ Postdoctoral | *Pós-Doutorado*

Other (please specify)

***32. [Governance experience] How long have you been participating or involved directly or indirectly in initiatives to support governance?**

[Experiência com governança] Há quanto tempo você está participando ou está envolvido, direta ou indiretamente, em iniciativas de apoio à governança?

- ◯ Up to 1 year | *Até 1 ano*
- ◯ From 1 to 5 years | *De 1 a 5 anos*
- ◯ From 6 to 10 years | *De 6 a 10 anos*
- ◯ From 11 to 15 years | *De 11 a 15 anos*
- ◯ From 16 to 20 years | *De 16 a 20 anos*
- ◯ More than 20 years | *Mais de 20 anos*

Comments

***33. [Agile/Lean experience] How long have you been participating or involved directly or indirectly in initiatives using lean or agile mindset (principles, values, practices, etc.)?**

[Experiência com ágil/lean] Há quanto tempo você está participando ou está envolvido, direta ou indiretamente, em iniciativas usando mentalidade ágil ou lean (princípios, valores, práticas, etc.)?

- ◯ Up to 1 year | *Até 1 ano*
- ◯ From 1 to 5 years | *De 1 a 5 anos*
- ◯ From 6 to 10 years | *De 6 a 10 anos*
- ◯ From 11 to 15 years | *De 11 a 15 anos*
- ◯ From 16 to 20 years | *De 16 a 20 anos*
- ◯ More than 20 years | *Mais de 20 anos*

Comments

12. Questions about your organization

Now, we would like to know more about your organization. This is very important for the analysis of your responses.
IMPORTANT: Whenever you wish, you can use the comments field of each question to add your own considerations (examples, criticisms or doubts) that could enrich the issues raised by them.
Agora, desejamos conhecer melhor o perfil de sua organização. Isso será muito importante para análise de suas respostas.
IMPORTANTE: Sempre que desejar, você pode usar o campo de comentários (Comments) de cada questão para adicionar suas próprias considerações (exemplos, críticas ou dúvidas) que possam enriquecer os pontos levantados por elas.

***34. [Organization size] How would you rate the size of the company where you work (or have worked recently)? (Use as reference the Table 1).**

[Tamanho da organização] Como você classificaria o tamanho da empresa onde você trabalha (ou trabalhou mais recentemente)? (Use como referência a Tabela 1)

- ◯ Micro
- ◯ Small | *Pequena*
- ◯ Medium | *Média*
- ◯ Large | *Grande*

Comments

Table 1 - Organization Size. Source: EU recommendation 2003/361 (EU, 2003). Obs.: The currency unit in the Table is the Euro.

Tabela 1 - Tamanho da organização. Fonte: União Européia recomendação 2003/361 (EU, 2003) **Obs.: A unidade monetária na tabela é o Euro.**

Size of Organization	Employees	AND	Billing (Million €)	OR	Total Assets (Million €)
Micro	<10	and	≤ 2	or	≤ 2
Small	<50	and	≤ 10	or	≤ 10
Medium	<250	and	≤ 50	or	≤ 43
Large	>250	and	> 50	or	> 43

***35. [Economy sector] In which industry sector your organization (predominantly) operates? Source: Adapted from (United Nations Statistics Division, 2014).**

[Setor econômico] Em qual setor da economia a sua empresa (predominantemente) atua? Fonte: Adaptado de (United Nations Statistics Division, 2014)

- [ ] A - Agriculture, forestry and fishing
- [ ] B - Mining and quarrying
- [ ] C - Manufacturing
- [ ] D - Electricity, gas, steam and air conditioning supply
- [ ] E - Water supply; sewerage, waste management and remediation activities
- [ ] F - Construction
- [ ] G - Wholesale and retail trade; repair of motor vehicles and motorcycles
- [ ] H - Transportation and storage
- [ ] I - Accommodation and food service activities
- [ ] J - Information and communication (including Information Technology)
- [ ] K - Financial and insurance activities
- [ ] L - Real estate activities
- [ ] M - Professional, scientific and technical activities
- [ ] N - Administrative and support service activities
- [ ] O - Public administration and defense; compulsory social security
- [ ] P - Education
- [ ] Q - Human health and social work activities
- [ ] R - Arts, entertainment and recreation
- [ ] S - Other service activities
- [ ] T - Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use
- [ ] U - Activities of extraterritorial organizations and bodies

Other unlisted activity (please specify)

Survey for assessing a representative model of the Agile Governance

***36. [Operating scale] What is the best classification for the operation scale of the organization where you work?**

[Escala de operação] Qual é a melhor classificação para a escala de operação da empresa onde você trabalha?

- ◯ Local
- ◯ Regional
- ◯ National
- ◯ Multinational (present in up to 5 countries) | *presente em até 5 países*
- ◯ Global (present in more than 5 countries) | *presente em mais de 5 países*

Comments

13. Questionnaire Analysis

The following questions will be important to help us analyze the data provided by you.
IMPORTANT: Whenever you wish, you can use the comments field of each question to add your own considerations (examples, criticisms or doubts) that could enrich the issues raised by them.
As próximas questões serão importantes para nos ajudar a analisar os dados fornecidos por você.
IMPORTANTE: Sempre que desejar, você pode usar o campo de comentários (Comments) de cada questão para adicionar suas próprias considerações (exemplos, críticas ou dúvidas) que possam enriquecer os pontos levantados por elas.

Assessment scale (for questions 37, 38 and 39)

Escala de Avaliação (para as questões 37, 38 e 39)

Criteria	Assessment scale							
Illustrative Legend	☹ Strongly Disagree		☹ Disagree partially		😐 Indifferent		☺ Agree partially	
Numeric Scale	1	2	3	4	5	6	7	8
Your answer: What is your level of agreement with the STATEMENT of the question?	I very strongly disagree	I strongly disagree	I very disagree	I disagree	I almost disagree	I almost agree	I agree	I very agree

Critérios	Escala de avaliação							
Legenda ilustrativa	☹ Discordo fortemente		☹ Discordo parcialmente		😐 Indiferente		☺ Concordo parcialmente	
Escala Numérica	1	2	3	4	5	6	7	8
Sua resposta: Qual o seu nível de concordância com a AFIRMAÇÃO da questão?	Eu discordo muito fortemente	Eu discordo fortemente	Eu discordo muito	Eu discordo	Eu quase discordo	Eu quase concordo	Eu concordo	Eu concordo muito

***37. [Actual adoption] The organization where I work (or I have worked) adopts an agile approach to handle with governance issues.**

[Atual adoção] A organização onde eu trabalho (ou trabalhei) adota uma postura ágil para lidar com questões de governança.

	1: Very strongly disagree *Discordo muito fortemente*	2	3	4	5	6	7	8	9	10: Very strongly agree *Concordo muito fortemente*
Answer *Resposta*	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

Comments

***38. [Future adoption] The organization where I work (or I have worked) has interest to adopt (or continue adopting) an agile approach to handle with governance issues.**

[Adoção futura] A organização onde eu trabalho (ou trabalhei) tem interesse em adotar (ou continuar adotando) uma postura ágil para lidar com questões de governança.

	1: Very strongly disagree *Discordo muito fortemente*	2	3	4	5	6	7	8	9	10: Very strongly agree *Concordo muito fortemente*
Answer *Resposta*	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

Comments

Survey for assessing a representative model of the Agile Governance

39. [Contribution]** ***"The development of a theory for extend the understanding about agile governance phenomena is a necessary contribution to industry and academy". How much do you agree with this statement?

[Contribuição] ***"O desenvolvimento de uma teoria para ampliar a compreensão sobre os fenômenos de governança ágil é uma contribuição necessária para a indústria e academia."***

O quanto você concorda com esta afirmação?

	1: Very strongly disagree *Discordo muito fortemente*	2	3	4	5	6	7	8	9	10: Very strongly agree *Concordo muito fortemente*
Answer *Resposta*	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯

Comments

40. [Feedback] If you are interested in receiving the results of this research, then fill in the following fields. (According to the confidentiality section of the survey Protocol: your personal data will not be disclosed.)

[Feedback] Se você estiver interessado em receber os resultados desta pesquisa, então preencha os seguintes campos. (De acordo com a seção de confidencialidade do Protocolo da pesquisa: seus dados pessoais não serão divulgados.)

Name:

Company:

City/Town:

State/Province:

Country:

Email Address:

41. [Suggestions] If you have any suggestion to improve this questionnaire or the ongoing research, please, fill in the field below.

[Sugestões] Se você tem alguma sugestão para melhorar este questionário ou a pesquisa em andamento, por favor, preencha no campo abaixo.

APPENDIX VI.4. Survey: Sample characterization

Follows further details about Explanatory Survey carried out by this study, in order to characterize the sample.

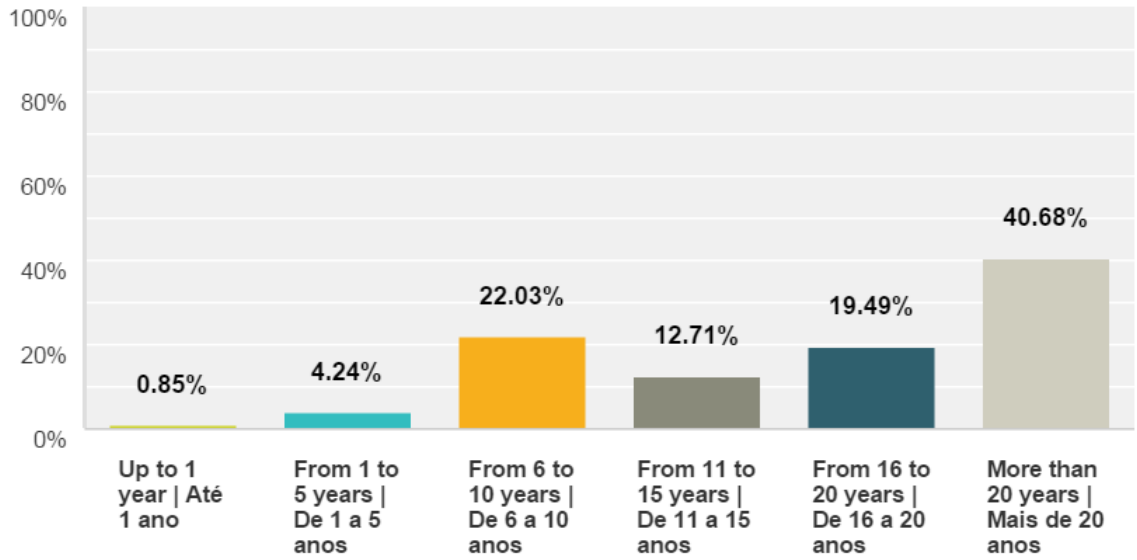


Figure VI.6 – Survey: respondents work experience experience ($\boldsymbol{n = 118}$). Source: Data repository on SurveyMonkey.

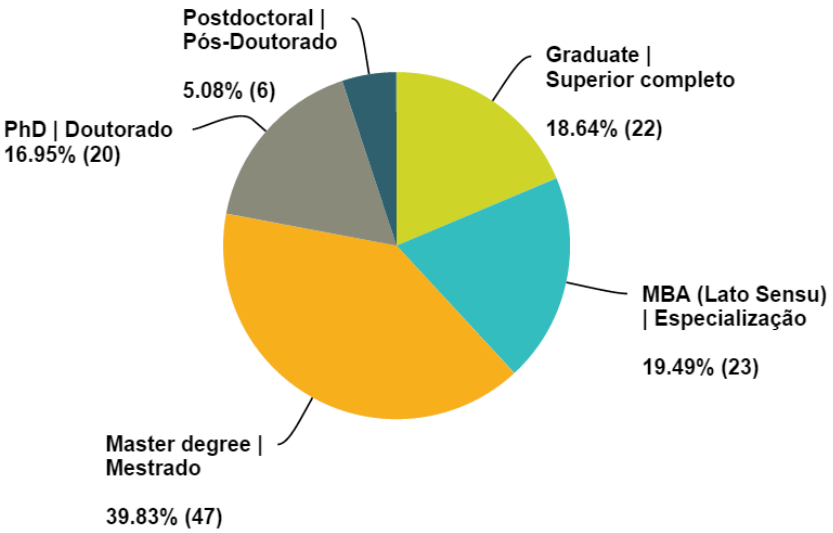


Figure VI.7 – Survey: respondents education ($\boldsymbol{n = 118}$). Source: Data repository on SurveyMonkey.

The respondents had the opportunity to describe their occupation. Some of them have declared more than one job position. This profile is depicted in Figure VI.8.

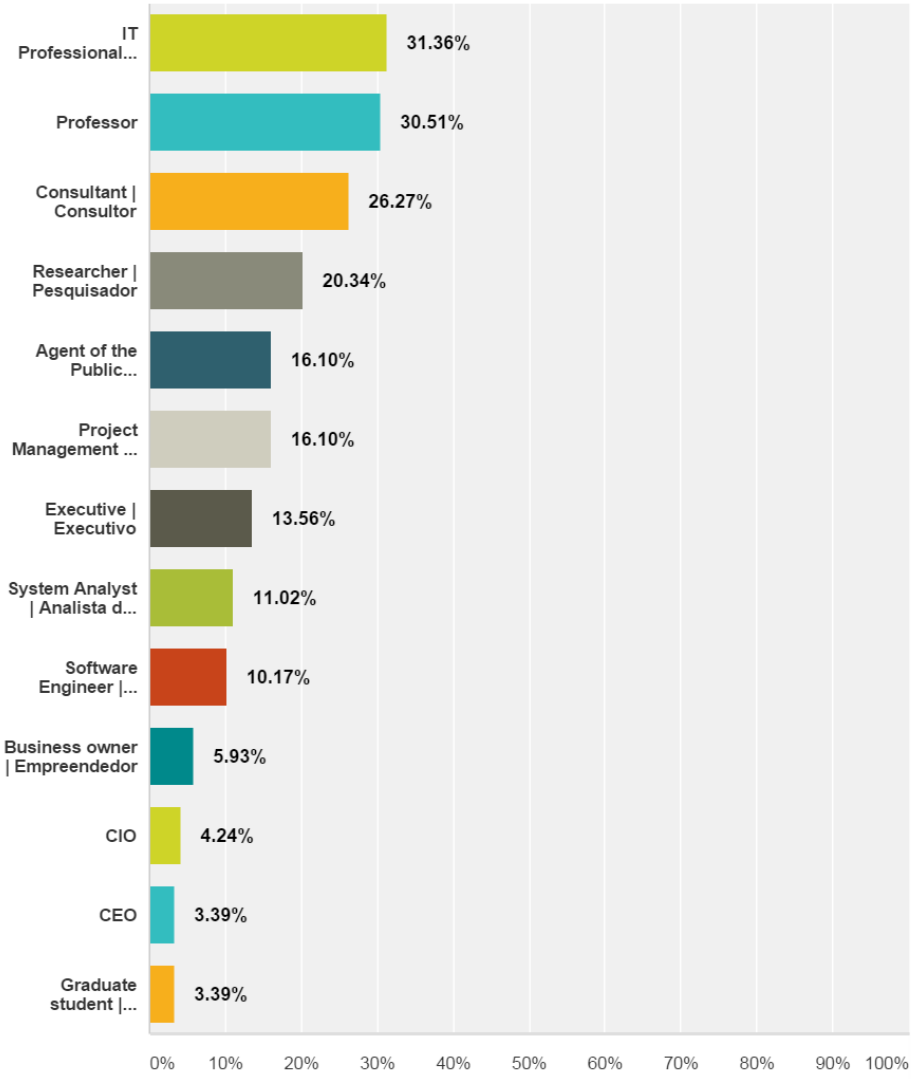


Figure VI.8 – Survey: respondents job position ($\boldsymbol{n = 118}$). Source: Data repository on SurveyMonkey.

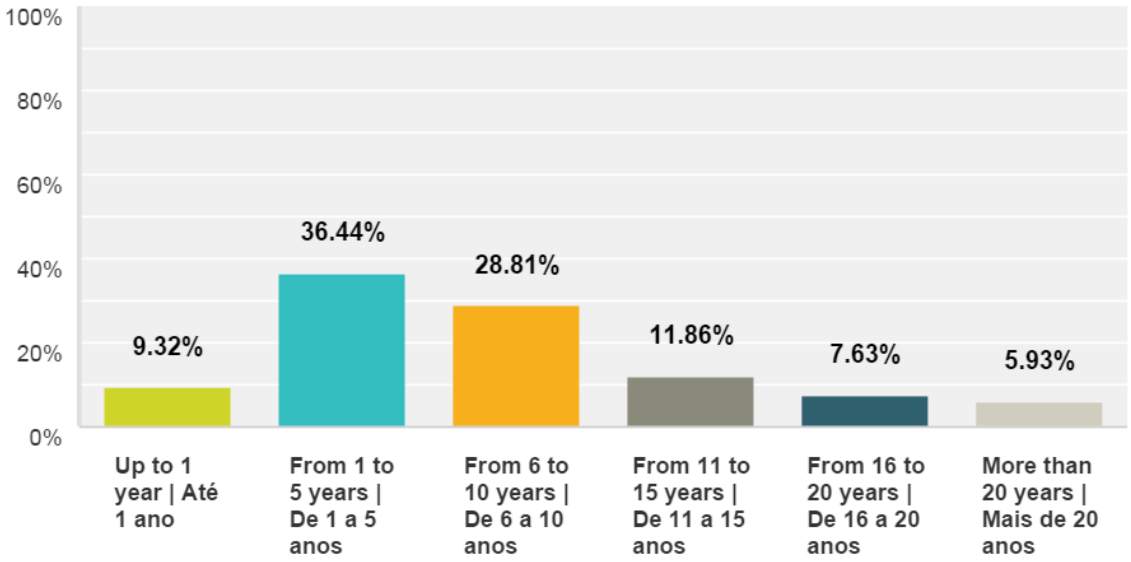


Figure VI.9 – Survey: respondents governance experience ($\boldsymbol{n = 118}$). Source: Data repository on SurveyMonkey.

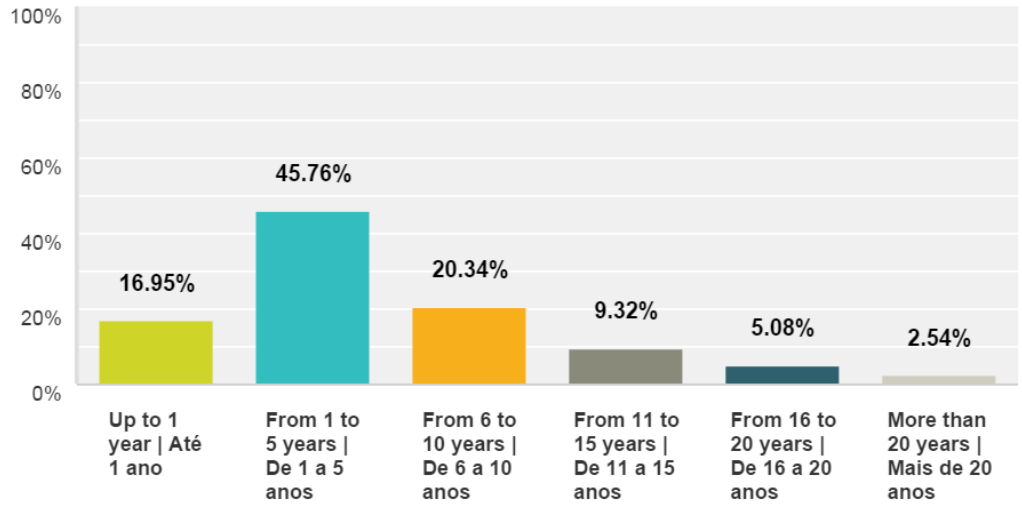


Figure VI.10 – Survey: respondents agile/lean experience ($\boldsymbol{n = 118}$). Source: Data repository on SurveyMonkey.

Also, we have collected data about the organization where the respondents work aiming delineate a broad scenario about their organizational contexts. The following figures depict this organizational profile.

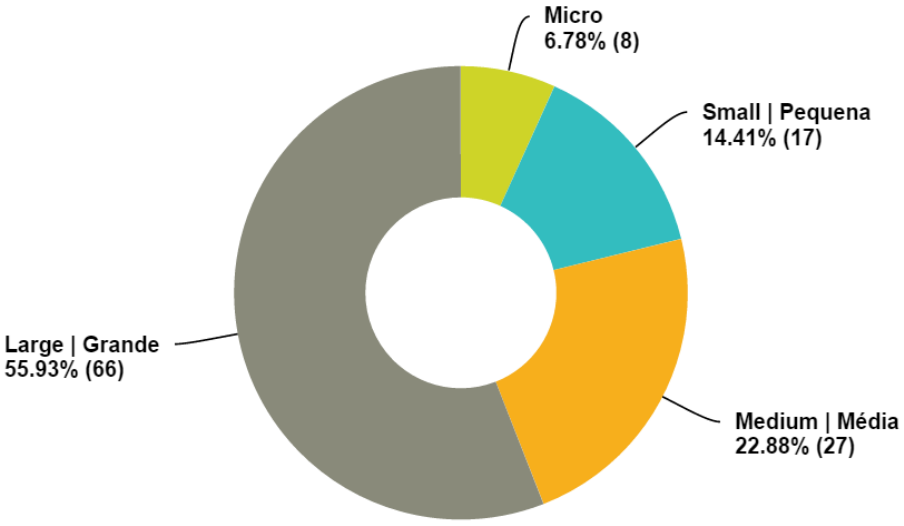
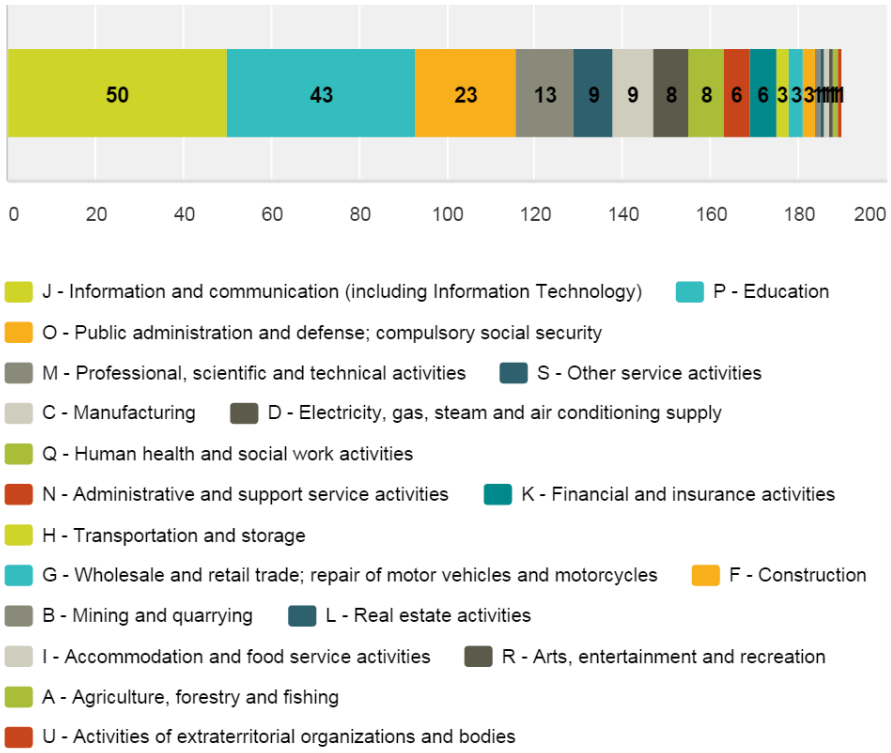


Figure VI.11 – Survey: organization size ($\boldsymbol{n = 118}$). Source: Data repository on SurveyMonkey.



Answer Choices	Responses	
J - Information and communication (including Information Technology) (10)	42.37%	50
P - Education (16)	36.44%	43
O - Public administration and defense; compulsory social security (15)	19.49%	23
M - Professional, scientific and technical activities (13)	11.02%	13
S - Other service activities (19)	7.63%	9
C - Manufacturing (3)	7.63%	9
D - Electricity, gas, steam and air conditioning supply (4)	6.78%	8
Q - Human health and social work activities (17)	6.78%	8
N - Administrative and support service activities (14)	5.08%	6
K - Financial and insurance activities (11)	5.08%	6
H - Transportation and storage (8)	2.54%	3
G - Wholesale and retail trade; repair of motor vehicles and motorcycles (7)	2.54%	3
F - Construction (6)	2.54%	3
B - Mining and quarrying (2)	0.85%	1
L - Real estate activities (12)	0.85%	1
I - Accommodation and food service activities (9)	0.85%	1
R - Arts, entertainment and recreation (18)	0.85%	1
A - Agriculture, forestry and fishing (1)	0.85%	1
U - Activities of extraterritorial organizations and bodies (21)	0.85%	1
Total Respondents: 118		

Figure VI.12 – Survey: organization economy sector ($\boldsymbol{n = 118}$). Source: Data repository on SurveyMonkey.

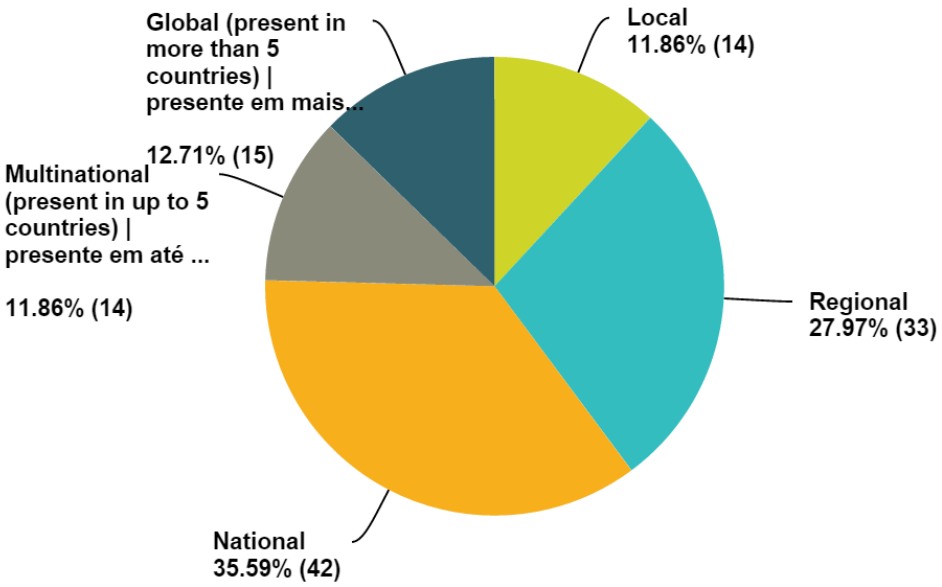


Figure VI.13 – Survey: organization operating scale ($\boldsymbol{n = 118}$). Source: Data repository on SurveyMonkey.

At the end of the questionnaire, we also asked how much the respondents have agreed with the following statement "*the development of a theory for extend the understanding about agile governance phenomena is a necessary contribution to industry and academy*". In fact, more than 83% of the respondents agreed that the ongoing research is a necessary contribution to industry and academy. **Figure VI.14** depicts the answer profile for that question.

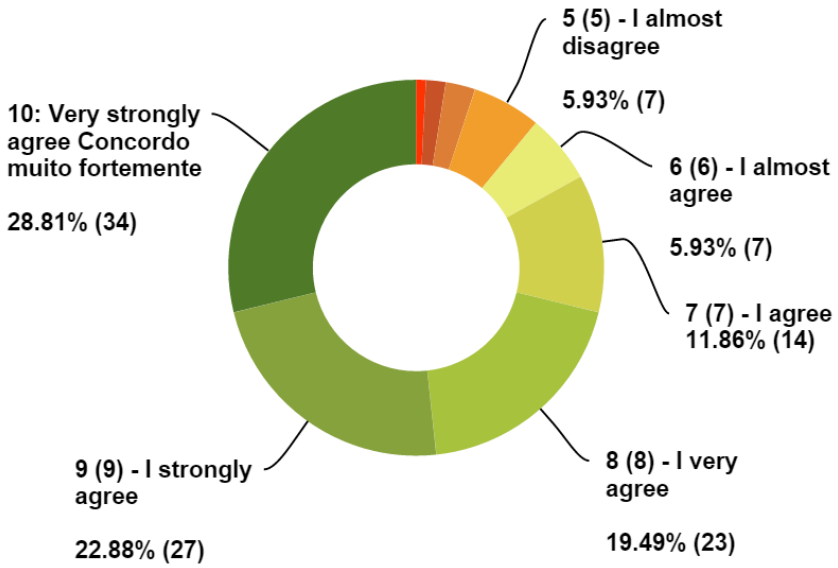


Figure VI.14 – Survey: research contribution ($\boldsymbol{n = 118}$). Source: Data repository on SurveyMonkey.

We have asked to the respondents how mouch they agreed with the the following statement "*the organization where I work has interest to adopt (or continue adopting) an agile approach to handle with governance issues*". Indeed, more than 58% of the respondents agreed that their organizations have interest to adopt (or continue adopting) agile governance. **Figure VI.15** depicts the answer profile for that question.

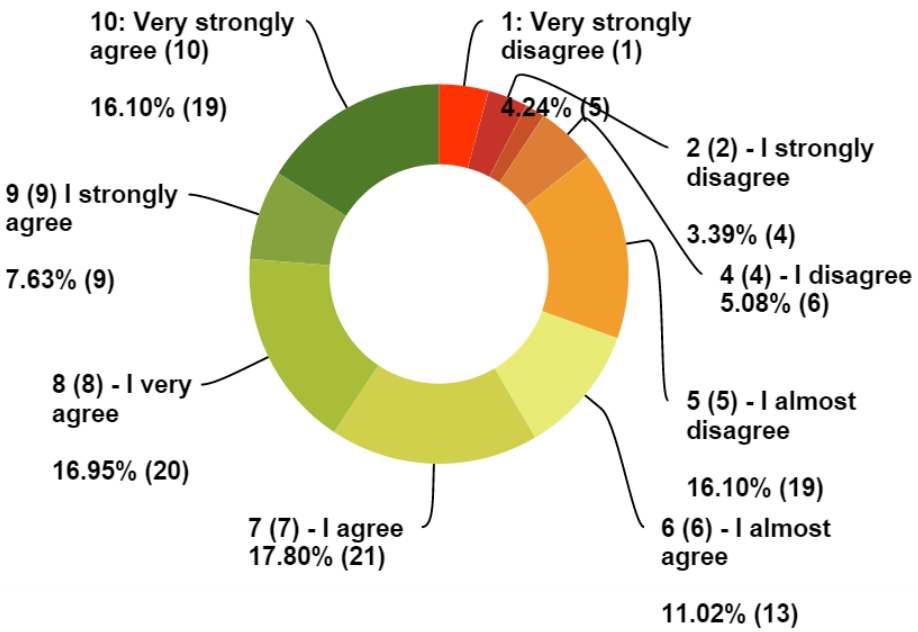


Figure VI.15 – Survey: agile governance adoption perspective ($\boldsymbol{n = 118}$). Source: Data repository on SurveyMonkey.

APPENDIX VII. Explanatory Survey: Statistical Analysis

APPENDIX VII.1. Verification of the assumptions for application of multivariate analysis

VII.1.1. Independence of observations

In this study, the **unit of analysis** is the "organizational context" performed by the environment comprised by the influence of social, economic, cultural, technological and political aspects related to positions and roles on individuals of a group, chosen by each respondent. As already previoulsy described it can be, in increasing order of complexity: team, project, business unit, enterprise, or a multi-organizational setting. Questionnaire respondents are professionals who have the expertise to evaluate the different dimensions of these organizational contexts.

The sampling process ensured the independence of observations, because, each respondent only has evaluated a unique organizational context. In complement, the sample has included five different types of organizational contexts, gathering in each one, varying characteristics of mindset (Q2, Q4), size (Q34), business sector (Q35), operating scale (Q36), and location (**Figure 5.8**).

The independence of observations is a basic assumption in SEM modeling, and the violation of this assumption in general, as notes (Marôco, 2014), cause for the increase of the estimates of standard errors of the model parameters, and the increasing of type II errors. This kind of error can lead us to conclude for the non-significance of a parameter, while it is significant to the population.

VII.1.2. Scale recoding and treatment of missing values

In order to facilitate understanding of the professionals to answer the questionnaire and to avoid distortions on the assessments of the variables which are to evaluate the organizational contexts, all questions were formulated with direct scale. Thus, the lower values indicate a weak influence of the factor that is being analyzed for the construct measure, while higher values indicate a high influence of the manifest variable in question.

Since there was no question using inverted scale, all observed variables were pointing in the same direction, as warned by (Dubin, 1978) and (Marôco, 2014).

On the other hand, we have identified lack of response (missing values) in the questionnaires in part from the 281 responses received. Indeed, this was one of the most frequently "discard criteria" found in sample (92%). According to the Survey protocol, 163 cases were discarded because they did not fully met the criteria established for research or they had missing values. Hence, it was possible to use 118 questionnaires in the statistical analysis.

VII.1.3. Internal consistency of the measuring instrument

The measurement scale of the questionnaire, strictly speaking, should be continuous to allow calculating the average, variance and covariance, necessary to estimate the model parameters. However, the use of discrete ordinal scales, such as Likert scale (Maurer and Pierce, 1998), in practice is quite common. Lomax and Schumacker (2012), and Marôco (2014) state that a greater number of classes in ordinal scale approximates the results to a corresponding quantitative metric. In this study was used an ordinal scale of 10 points by following these recommendations.

In addition, the reliability and validity of the measuring instrument should be evaluated. In general, the ***reliability*** measures the degree wherein a set of indicators is consistent to measure a latent construct, i.e., if such instrument when applied to a given sample, is free of random measurement errors, and can be used (reproduced) in other samples.

Table VII.1 – Internal consistency of the questionnaire: based on the gathered data reliability. Source: Own elaboration.

Measurement instrument	**Number of Items**	**Cronbach's Alpha (*standardized α*)**	**Reliability analysis according to** (Gliem and Gliem, 2003; Murphy and Davidshofer, 2005)
Global	24	0.914 *(0.915)*	Excellent
Effects of environmental factors [E]	5	0.714 *(0.715)*	Good
Effects of moderator factors [M]	5	0.861 *(0.861)*	Very good
Agile capabilities [A]	4	0.880 *(0.883)*	Very good
Governance capabilities [G]	4	0.823 *(0.835)*	Very good
Business operations [B]	3	0.786 *(0.785)*	Good
Value delivery [R]	3	0.808 *(0.809)*	Very good

The type of reliability coefficient reported more frequently in the literature is called **Cronbach's Alpha coefficient** ($0 \leq \alpha \leq 1$). This statistic indicator measures the internal consistency of the

data, i.e., the coherence of the answers that evaluate a given item. According to Cronbach and Meehl (1955), and Murphy and Davidshofer (2005), values above 0.7 are indicative of good data consistency. **Table VII**.1 depicts the results of the analysis for global internal consistency (whole questionnaire), and for each latent variable that the instrument proposes to measure.

We can observe that the Cronbach's Alpha is greater than 0.7 in all cases, suggesting good internal consistency of the questionnaire to measure the variables under study.

VII.1.4. Univariate and multivariate normality

In SEM modeling, the calculation of the model parameters (factor weights, regression coefficients, covariance, etc.) aims to reproduce the best possible sample data obtained by the instrument.

This step is called "model estimation" (step 4, **Figure 2.12**), and it is carried out using specific SEM software, and applying numerical methods which use some iterative algorithm in order to meet some convergence requirements. The most widely used method in SEM is the *Maximum Likelihood* method, and a requirement for its application is that the observed data demonstrate multivariate normality. Indeed, many cases of multivariate normality absence are detectable by inspection univariate distributions. Hence, is common to observe the measures of the distribution forms, i.e., *univariate skewness* (sk), and *flattening* or *kurtosis* (ku) (Marôco, 2014).

Kline (2011) and Marôco (2014) suggest that a set of variables, presenting univariate normal distribution, will have, with some exceptions, multivariate normal distribution. From simulation studies reported by Kline (2011), it is assumed that the absolute values $sk > 3$ and $ku > 10$ indicate normality violations. Moreover, Lomax and Schumacker (2012) cite the use of *critical ratio* (CR) as a parameter to evaluate the normality of the variables.

The critical ratio represents the value of sk (or ku) divided by the standard error of sk (or ku), this ratio is interpreted as the value z (standard normal variable), thus, critical ratio value above 3 indicates distortions statistically significant. **Table VII**.2 depicts the assessment results of the univariate and multivariate normality for manifest variables regarding to the model depicted in **Figure 5.13**, based on the **Startup scenario (φ_4)**, using *IBM® SPSS® Amos 20.0* software.

Table VII.2 – Skewness, Kurtosis and Critical ratios from model's manifest variables ($\boldsymbol{n = 118}$). Source: Own elaboration from AMOS.

	Skewness	Critical ratio of (sk)	Kurtosis	Critical ratio of (ku)	Assessment of normality			
Variable	$\boldsymbol{sk}$	$\boldsymbol{CR_{sk}}$	$\boldsymbol{ku}$	$\boldsymbol{CR_{ku}}$	$sk \leq 3$?	$ku \leq 10$?	$CR_{sk} \leq 3$?	$CR_{ku} \leq 3$?
$\boldsymbol{x_1}$	-0.775	-3.438	0.849	1.883	OK	OK	OK	OK
$\boldsymbol{x_2}$	-0.821	-3.641	0.559	1.240	OK	OK	OK	OK
$\boldsymbol{x_3}$	-0.688	-3.050	0.991	2.198	OK	OK	OK	OK
$\boldsymbol{x_4}$	-0.243	-1.076	-0.743	-1.646	OK	OK	OK	OK
$\boldsymbol{x_5}$	-0.570	-2.528	0.372	0.825	OK	OK	OK	OK
$\boldsymbol{y_1}$	-1.142	-5.063	1.148	2.545	OK	OK	OK	OK
$\boldsymbol{y_2}$	-0.958	-4.247	0.130	0.287	OK	OK	OK	OK
$\boldsymbol{y_3}$	-0.805	-3.571	0.032	0.070	OK	OK	OK	OK
$\boldsymbol{y_4}$	-0.832	-3.688	0.405	0.897	OK	OK	OK	OK
$\boldsymbol{y_5}$	-0.793	-3.518	-0.266	-0.590	OK	OK	OK	OK
$\boldsymbol{y_6}$	-1.055	-4.679	0.541	1.200	OK	OK	OK	OK
$\boldsymbol{y_7}$	-1.114	-4.940	1.517	3.363	OK	OK	OK	**NO**
$\boldsymbol{y_8}$	-0.728	-3.230	0.066	0.145	OK	OK	OK	OK
$\boldsymbol{y_9}$	-0.954	-4.231	1.239	2.748	OK	OK	OK	OK
$\boldsymbol{y_{10}}$	-0.800	-3.546	0.285	0.631	OK	OK	OK	OK
$\boldsymbol{y_{11}}$	-0.875	-3.881	1.364	3.024	OK	OK	OK	**NO**
$\boldsymbol{y_{12}}$	-0.281	-1.247	-0.431	-0.956	OK	OK	OK	OK
$\boldsymbol{y_{13}}$	-0.934	-4.141	0.634	1.405	OK	OK	OK	OK
$\boldsymbol{y_{14}}$	-0.518	-2.297	0.021	0.047	OK	OK	OK	OK
$\boldsymbol{y_{15}}$	-0.347	-1.540	-0.454	-1.006	OK	OK	OK	OK
$\boldsymbol{y_{16}}$	-0.297	-1.317	-0.507	-1.124	OK	OK	OK	OK
$\boldsymbol{y_{17}}$	-0.316	-1.400	0.010	0.022	OK	OK	OK	OK
$\boldsymbol{y_{18}}$	-0.532	-2.358	-0.339	-0.752	OK	OK	OK	OK
$\boldsymbol{y_{19}}$	-0.723	-3.205	-0.063	-0.140	OK	OK	OK	OK
Multivariate			**99.398**	**15.282**	**OK**	**OK**	**OK**	**Partial**

Analyzing the values of critical ratios for *univariate skewness* (sk) and *kurtosis* (ku), it is observed the absence violation of the normality assumption. However, the critical ratio for kurtosis (CR_{ku}) indicates the absence of normality in two variables of the model from the sample data: y_7 (Leanness) and y_{11} (Decision making).

According to Lomax and Schumacker (2012), the non-normality problem occurs because of the variable scale (ordinal rather than interval) or due to a limited sample size. Both situations are present in this research.

In keeping with Lomax and Schumacker (2012), Kline (2011) and Marôco (2014), the suggestions to solve this difficulty are: i) make an admissible linear transformation on the data, for example by calculating the square root or logit or probit transformation; ii) increase the

sample size; or iii) apply Bootstrap methods available in the SEM software. For practical reasons, in this study we have adopted the third suggestion, i.e., the *Bootstrap estimation* available in the *IBM® SPSS® Amos 20.0* software, with 2,000 resampling.

This method uses a bootstrap resampling procedure with replacement from a single sample (original sample). The method provides a way to assess the empirical distribution increasing the precision of the estimates of the parameters. As a consequence, considering a sufficiently high number of samples, the parameter estimates do not suffer from the limitations imposed for data with multivariate normal distribution.

VII.1.5. Nonzero sample covariance

The observed variables used to measure the latent constructs should be correlated each other in a manner that can be possible to operationalize the calculations for the model parameters. This property is evaluated along the exploratory factor analysis (EFA) and confirmatory (CFA), in coming Sections, from the Section 5.2.4 of the Chapter 5.

VII.1.6. Multicollinearity absence

As highlighted by Kline (2011), although can be theoretically possible that the SEM software generates a unique set of parameters estimates for the identified model, the analysis can still be hampered by other problems related to the data sample. One of such problem is the extreme multicollinearity among the exogenous variables (independent) from model.

This phenomenon occurs when one or more independent variables are redundant, because they can be written as an almost perfect linear combination of the other exogenous variables observed. Lomax and Schumacker (2012), and Marôco (2014) refer to this problem as "model empirically underidentified". To evaluate the absence of multicollinearity of the exogenous variables, statistics is used "*Variance Inflation Factor*" (VIF) to measure how much of the variance of a regression coefficient estimated is greater because of collinearity. Usually, there is multicollinearity when values of $VIF \geq 5$.

Adopting *IBM® SPSS® Statistics* 20.0, within the multiple linear regression, was elaborated the Table 6.3, which presents the VIFs values for the exogenous variable ***Effects of environmental factors [E]*** for the model depicted in **Figure 5.13**.

Table VII.3 – Evaluation of multicollinearity of the exogenous manifest variables of the model from Figure 5.13 ($\boldsymbol{n = 118}$). Source: Own elaboration.

		VIF from Independent Variables				
Regression	**Dependent Variable**	x_1	x_2	x_3	x_4	x_5
1	x_1	-	1.412	1.559	1.482	1.459
2	x_2	1.207	-	1.288	1.354	1.352
3	x_3	1.128	1.089	-	1.119	1.134
4	x_4	1.377	1.470	1.437	-	1.342
5	x_5	1.368	1.483	1.470	1.355	-

From Table VII.3, we can conclude that the exogenous sample manifest variables of this study do not present a linear relationship, due to all VIF values are smaller 5.

VII.1.7. Absence of non-standard values (*outliers*)

In keeping with Marôco (2014), *outliers* are values outside the dataset trend, which can be explained by: observational errors, errors in data entry, and errors from measurement instruments, or even they can be real values from the sample. These extreme values cause changes in the values of covariance, means, standard deviations and other parameters, compromising, in general, the quality of model adjustment (Lomax and Schumacker, 2012).

As highlighted by Marôco (2014), the evaluation of *outliers absence* is a necessary step in the SEM model validation process. Usually, SEM softwares provide routines for diagnosis of possible outliers. The most commonly used measure for diagnostic *multivariate outliers* is the *Mahalanobis Distance (D)*, which measures the distance in standard deviation units, from an observation x_i over the average of all observations related to all variables (*centroid*). For large samples, according to Kline (2011), with normal distributions, D^2 follows a chi-square distribution (χ^2) with degrees of freedom equal to the number of variables.

To check outliers presence in the sample, using the SEM software, we calculate the probability (p_1) related to an observation x_i has a distance (D^2) higher than ${d_i}^2$ calculated for this observation, as well as it is also calculate the probability (p_2) of the largest *Mahalanobis Distance (D)* to exceed ${d_i}^2$. It is expected for most of observations that occurs **small values for $\boldsymbol{p_1}$** and **higher values for $\boldsymbol{p_2}$**. When **both values ($\boldsymbol{p_1}$ and $\boldsymbol{p_2}$) are small (< 0.05)**, that observation can be classified as a multivariate outlier (Arbuckle, 2011). In our sample, the evaluation of the *Mahalanobis Distance* identified **sixteen** outliers depicted in **Table VII**.4.

Table VII.4 – Evaluation of *outliers* based on *Mahalanobis Distance* ($\boldsymbol{D}$) ($\boldsymbol{n = 118}$). Source: Own elaboration.

Observation number (n)	Mahalanobis d-squared (D^2)	p_1	p_2
107	60.962	0	0.001
18	47.62	0	0.002
64	45.622	0.001	0
118	45.594	0.001	0
114	44.699	0.001	0
54	39.614	0.006	0
101	36.785	0.012	0.001
20	35.284	0.019	0.002
86	35.242	0.019	0
92	34.784	0.021	0
43	34.304	0.024	0
57	34.137	0.025	0
12	33.824	0.027	0
84	33.515	0.03	0
35	33.147	0.033	0
6	31.482	0.049	0

As described in the following Sections of this chapter, there was no impact of these outliers in successive adjustments in the model, allowing using the sample of 118 cases.

APPENDIX VII.2. Exploratory Factor Analysis (EFA)

For each *latent variable* (construct) of the model derived from the emerging theory depicted in Chapter 4, we have followed the same procedure depicted in Section 5.2.4.1. In the following Sections, in short, we will discuss the relevant aspects of the EFA analysis for each remaining construct from model derived of the emerging theory.

VII.2.1. EFA for Effects of moderator factors [M]

The EFA analysis for the *latent variable* ***Effects of moderator factors [M]*** was performed with the five *manifest exogenous variables* from the original model depicted in **Figure 5.13**, i.e., y_1, y_2, y_3, y_4, and y_5.

The first results analyzed sets out the *KMO* (*Measure of Sampling Adequacy-MSA*) with acceptable value of $0.856 > 0.5$; and a *Bartlett's Test of Sphericity* with *significance* level lesser than 0.001. Further, we have identified all diagonal elements of the *anti-image matrix* are greater than 0.5.

However, the communality value for y_2 (0.489) was lesser than 0.5. The variable y_2 was considered in the model to measure the influence of the "***inadequacy of leadership style***" upon the organizational context, as a measure to understand the *Effects of moderator factors [M]*.

The literature (including findings from our review) points out widely leadership as a critical success factor for any organizational context, and even more when it is related to governance issues. Crossing data from: (1) comments left in Q11 of the questionnaire by the respondents; (2) sampling profiles depicted in **Table 5.4**; and, (3) qualification profile from sampling, based on Q29 (work experience) and Q31 (Education); we can imply that people who have answered our Survey are competent professionals, some of them exercise leadership in the day-to-day of their functions. In fact, some of them even have prominent leading "Job positions" (Q30) in their organizations, as CEO, CIO or Business Owner (13.6%). As a consequence, "***inadequacy of leadership style***" might not be a common moderating factor in their professional contexts, which influenced the response profile for the variable y_2.

Considering these arguments, it was understood that the variable y_2 should be removed from the analysis because the common factor does not adequately explain the variance of this item. After this modification, was conducted again the EFA to construct [M], with four manifest variables (y_1, y_3, y_4, and y_5).

Table VII.5 presents the new KMO values and the Bartlett test depicting the appropriateness of factor analysis to the data sample.

Table VII.5 – KMO and Bartlett's Test: for [M], after removing of y_2. Source: Own elaboration from SPSS.

Statistical tests and measures		Calculated values
KMO (Measure of Sampling Adequacy-MSA)		0.825
Bartlett's Test of Sphericity	Approx. Chi-Square	207.359
	Degrees of freedom (df)	6
	Significance	0.000

Table VII.6 depicts the *anti-image matrix* with all elements of the main diagonal greater than 0.50.

Table VII.6 – Anti-image Correlation Matrix: for [M], after removing of y_2. Source: Own elaboration from SPSS.

	y_1	y_3	y_4	y_5
y_1	0.820[a]	-0.357	-0.262	-0.234
y_3	-0.357	0.815[a]	-0.322	-0.173
y_4	-0.262	-0.322	0.817[a]	-0.298
y_5	-0.234	-0.173	-0.298	0.853[a]

a. Measures of Sampling Adequacy (MSA)

After adjustments, all commonalities from **Table VII**.7 are greater than 0.50, indicating that much of the variance of the manifest items is explained by the [M] factor.

Table VII.7 – Communalities: for [M], after removing of y_2. Source: Own elaboration from SPSS.

Meaning	Variable	Communalities
Organizational culture	y_1	0.721
Enterprise architecture	y_3	0.721
Business model	y_4	0.731
People	y_5	0.655

According to **Table VII**.8, there is a unique eigenvalue (*Eigenvalue*) greater than 1. Thus, by the latent root criterion, to derive the number of factors, there is a single component to be extracted for these variables.

Table VII.8 – Total Variance Explained for [M], from the extracted components (after removing of y_2). Source: Own elaboration from SPSS.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.829	70.719	70.719	2.829	70.719	***70.719***
2	0.459	11.482	82.201			
3	0.371	9.271	91.472			
4	0.341	8.528	100.000			

Extraction Method: Principal Component Analysis.

Furthermore, the *cumulative proportion of explained variance* ($\geq 60\%$) is satisfied with one component, that is, the solution proposed by *IBM® Statistics SPSS* 20.0 software could explain 70.719% of the total variance. This result can be also displayed graphically in **Figure VII.1**.

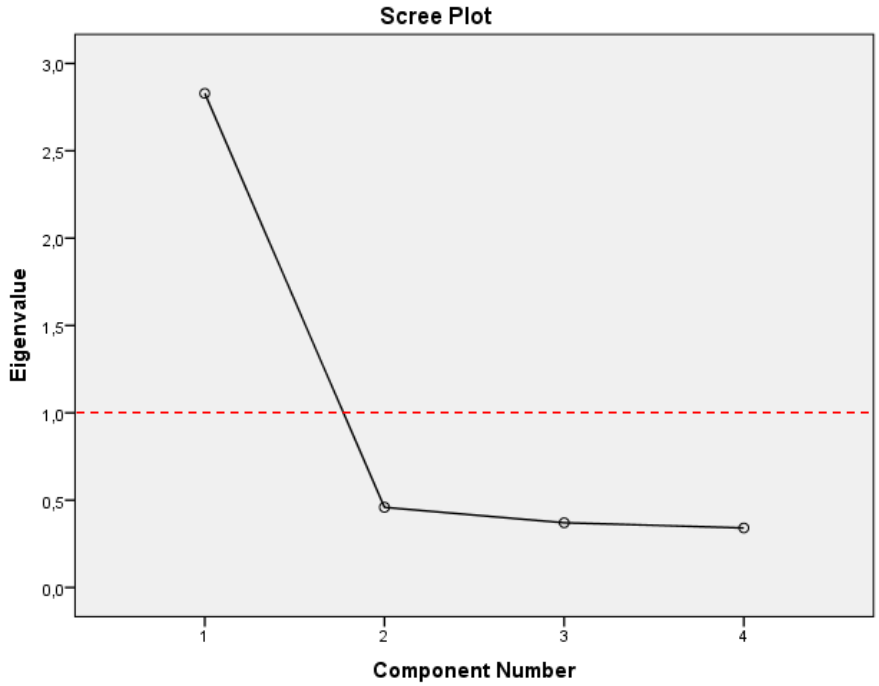


Figure VII.1 – Eigenvalues as a function of the number of components for latent variable [M]. Source: Own elaboration from SPSS.

Finally, **Table VII**.9 depicts the factor loadings for each variable. In this case only one component was extracted, and therefore, the solution cannot be rotated.

Table VII.9 – Component Matrix: for [M], after removing of y_2. **Source:** Own elaboration from SPSS.

	Component 1[a]
y_1	0.849
y_3	0.849
y_4	0.855
y_5	0.809

[a.] 1 component extracted.

As a consequence, the results of the EFA reported in this Section, to the construct ***Effects of moderator factors [M]***, will be later incorporated into the redesign of the complete theoretical model.

VII.2.2. EFA for Agile capabilities [A]

The EFA analysis for the *latent variable* ***Agile capabilities [A]*** was performed with the four *manifest exogenous variables* from the original model depicted in **Figure 5.13**, i.e., y_6, y_7, y_8, and y_9.

The first results analyzed sets out the *KMO* (*Measure of Sampling Adequacy-MSA*) with acceptable value of $0.832 > 0.5$; and a *Bartlett's Test of Sphericity* with *significance* level lesser than 0.001. **Table VII**.10 presents the new KMO values and the Bartlett test depicting the appropriateness of factor analysis to the data sample.

Table VII.10 – KMO and Bartlett's Test: for [A]. Source: Own elaboration from SPSS.

Statistical tests and measures		Calculated values
KMO (Measure of Sampling Adequacy-MSA)		0.832
Bartlett's Test of Sphericity	Approx. Chi-Square	253.001
	Degrees of freedom (df)	6
	Significance	0.000

Table VII.11 depicts the *anti-image matrix* with all elements of the main diagonal greater than 0.50.

Table VII.11 – Anti-image Correlation Matrix: for [A]. Source: Own elaboration from SPSS.

	y_6	y_7	y_8	y_9
y_6	0.888[a]	-0.252	-0.241	-0.111
y_7	-0.252	0.806[a]	-0.358	-0.387
y_8	-0.241	-0.358	0.824[a]	-0.331
y_9	-0.111	-0.387	-0.331	0.829[a]

a. Measures of Sampling Adequacy (MSA)

After adjustments, all communalities from **Table VII**.12 are greater than 0.50, indicating that much of the variance of the manifest items is explained by the [A] factor.

Table VII.12 – Communalities: for [A]. Source: Own elaboration from SPSS.

Meaning	Variable	Communalities
Flexibility	y_6	0.638
Leanness	y_7	0.797
Agility	y_8	0.780
Adaptability	y_9	0.751

According to **Table VII**.13, there is a unique eigenvalue (*Eigenvalue*) greater than 1. Thus, by the latent root criterion, to derive the number of factors, there is a single component to be extracted for these variables.

Table VII.13 – Total Variance Explained for [A], from the extracted components. Source: Own elaboration from SPSS.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.967	74.169	74.169	2.967	74.169	***74.169***
2	0.469	11.730	85.899			
3	0.296	7.393	93.293			
4	0.268	6.707	100.000			

Extraction Method: Principal Component Analysis.

Furthermore, the *cumulative proportion of explained variance* ($\geq 60\%$) is satisfied with one component, that is, the solution proposed by *IBM® Statistics SPSS* 20.0 software could explain 74.169% of the total variance. This result can be also displayed graphically in **Figure VII.2**.

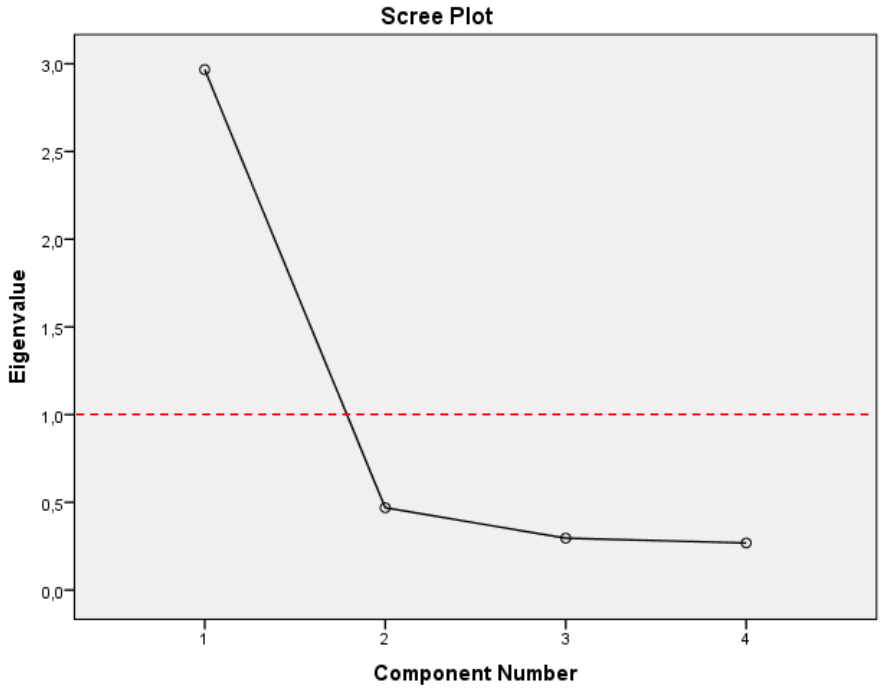


Figure VII.2 – Eigenvalues as a function of the number of components for latent variable [A]. Source: Own elaboration from SPSS.

Finally, **Table VII**.14 depicts the factor loadings for each variable. In this case only one component was extracted, and therefore, the solution cannot be rotated.

Table VII.14 – Component Matrix: for [A]. **Source:** Own elaboration from SPSS.

	Component 1[a]
y_6	0.799
y_7	0.893
y_8	0.883
y_9	0.867

[a.] 1 component extracted.

In case of the construct ***Agile capabilities [A]***, the EFA analysis did not generate any adjustment to the model, otherwise, those adjustments would be later incorporated into the redesign of the complete theoretical model.

VII.2.3. EFA for Governance capabilities [G]

The EFA analysis for the *latent variable* ***Governance capabilities [G]*** was performed with the four *manifest exogenous variables* from the original model depicted in **Figure 5.13**, i.e., y_{10}, y_{11}, y_{12}, and y_{13}.

The first results analyzed sets out the *KMO* (*Measure of Sampling Adequacy-MSA*) with acceptable value of $0.755 > 0.5$; and a *Bartlett's Test of Sphericity* with *significance* level lesser than 0.001. Further, we have identified all diagonal elements of the *anti-image matrix* are greater than 0.5.

However, the communality value for y_{13} (0.437) was lesser than 0.5. The variable y_{13} was considered in the model to measure the influence of the "***Compliance***" upon the organizational context, as a measure to understand how the *level of compliance* from an organizational context can impact in the development of *Governance capabilities [G]*, in order "*to ensure the strategy accomplishment*" on business operations.

We recognize that is a hard measure to do using a questionnaire, and probably the wording clarity of the question could be influenced the answer profile for this question. We may infer that we might have generated an “infighting” into respondents’ mind, when we have asked to them to point out their level of agreement with the statement of the question Q22 (based on their own experience in the organizational context chosen at the question Q2): “*You have experienced circumstances where the capability ‘to ensure regulatory compliance status’ of business operations (e.g., complying with organizational policies, legislation, international*

standards, market rules, etc.) was essential to guarantee the achievement of the objectives of the organization and its projects".

According to findings gathered during our **Observation on professional groups based on Social Networks (SNME)**, and the **Semi-structured Interviews (SEI)** carried out with representative agents from the phenomena in study, we may imply that culturally people see "**compliance**" as a "*straitjacket*", something that is not remembered as a component that positively influences on business operations. Even the steering committees members regard this concept as a "necessary evil", in order to "*put things on track*". As learned lesson, these evidences suggest that we must consider this kind of *cultural insights* (and *subtleties*) during development of questionnaires, in future studies, in order to avoid this type of bias.

Considering these arguments, it was understood that the variable y_{13} should be removed from the analysis because the common factor does not adequately explain the variance of this item. After this modification, was conducted again the EFA to construct [G], with three manifest variables (y_{10}, y_{11}, and y_{12}).

Table VII.15 presents the new KMO values and the Bartlett test depicting the appropriateness of factor analysis to the data sample.

Table VII.15 – KMO and Bartlett's Test: for [G], after removing of $\boldsymbol{y_{13}}$. **Source:** Own elaboration from SPSS.

Statistical tests and measures		Calculated values
KMO (Measure of Sampling Adequacy-MSA)		0.731
Bartlett's Test of Sphericity	Approx. Chi-Square	170.595
	Degrees of freedom (df)	3
	Significance	0.000

Table VII.16 depicts the *anti-image matrix* with all elements of the main diagonal greater than 0.50.

Table VII.16 – Anti-image Correlation Matrix: for [G], after removing of $\boldsymbol{y_{13}}$. **Source:** Own elaboration from SPSS.

	$\boldsymbol{y_{10}}$	$\boldsymbol{y_{11}}$	$\boldsymbol{y_{12}}$
$\boldsymbol{y_{10}}$	0.729[a]	-0.517	-0.291
$\boldsymbol{y_{11}}$	-0.517	0.697[a]	-0.410
$\boldsymbol{y_{12}}$	-0.291	-0.410	0.778[a]

a. Measures of Sampling Adequacy (MSA)

After adjustments, all communalities from **Table VII**.17 are greater than 0.50, indicating that much of the variance of the manifest items is explained by the [G] factor.

Table VII.17 – Communalities: for [G], after removing of y_{13}. **Source:** Own elaboration from SPSS.

Meaning	Variable	Communalities
Strategic alignment	y_{10}	0.793
Decision making	y_{11}	0.823
Control	y_{12}	0.757

According to **Table VII**.18, there is a unique eigenvalue (*Eigenvalue*) greater than 1. Thus, by the latent root criterion, to derive the number of factors, there is a single component to be extracted for these variables.

Table VII.18 – Total Variance Explained for [G], from the extracted components (after removing of y_{13}). **Source:** Own elaboration from SPSS.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.373	79.108	79.108	2.373	79.108	***79.108***
2	0.362	12.082	91.190			
3	0.264	8.810	100.000			

Extraction Method: Principal Component Analysis.

Furthermore, the *cumulative proportion of explained variance* ($\geq 60\%$) is satisfied with one component, that is, the solution proposed by *IBM® Statistics SPSS* 20.0 software could explain 79.108% of the total variance. This result can be also displayed graphically in **Figure VII.3**.

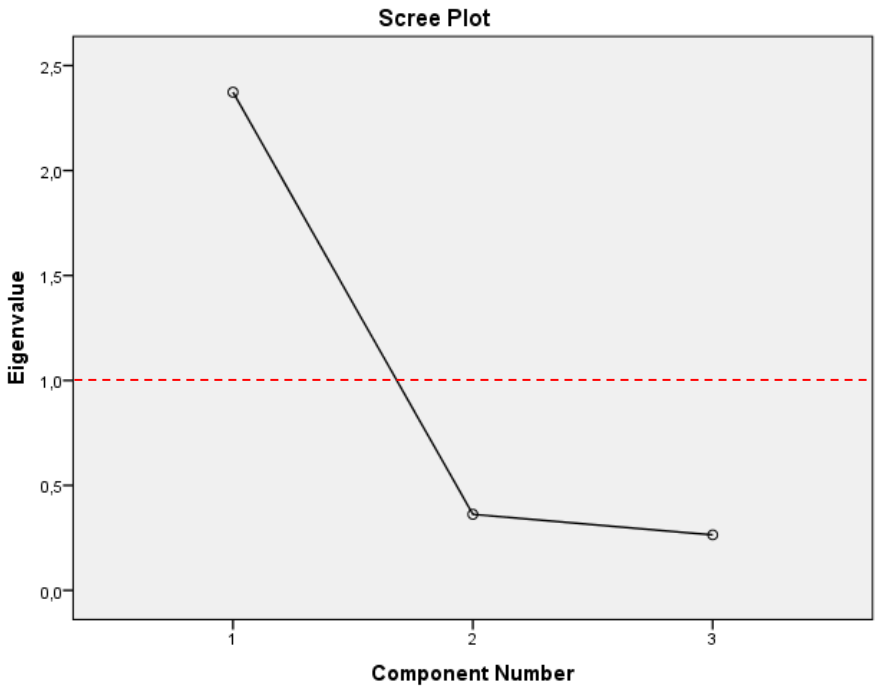


Figure VII.3 – Eigenvalues as a function of the number of components for latent variable [G]. **Source**: Own elaboration from SPSS.

Finally, **Table VII**.19 depicts the factor loadings for each variable. In this case only one component was extracted, and therefore, the solution cannot be rotated.

Table VII.19 – Component Matrix: for [G], after removing of y_{13}. **Source:** Own elaboration from SPSS.

	Component 1[a]
y_{10}	0.890
y_{11}	0.907
y_{12}	0.870

[a.] 1 component extracted.

As a consequence, the results of the EFA reported in this Section, to the construct ***Governance capabilities [G]***, will be later incorporated into the redesign of the complete theoretical model.

VII.2.4. EFA for Business operations [B]

The EFA analysis for the *latent variable* ***Business operations [B]*** was performed with the three *manifest exogenous variables* from the original model depicted in **Figure 5.13**, i.e., y_{14}, y_{15}, and y_{16}.

The first results analyzed sets out the *KMO* (*Measure of Sampling Adequacy-MSA*) with acceptable value of $0.671 > 0.5$; and a *Bartlett's Test of Sphericity* with *significance* level lesser than 0.001. **Table VII**.20 presents the new KMO values and the Bartlett test depicting the appropriateness of factor analysis to the data sample.

Table VII.20 – KMO and Bartlett's Test: for [B]. **Source:** Own elaboration from SPSS.

Statistical tests and measures		Calculated values
KMO (Measure of Sampling Adequacy-MSA)		0.671
Bartlett's Test of Sphericity	Approx. Chi-Square	108.304
	Degrees of freedom (df)	3
	Significance	0.000

Table VII.21 depicts the *anti-image matrix* with all elements of the main diagonal greater than 0.50.

Table VII.21 – Anti-image Correlation Matrix: for [B]. **Source:** Own elaboration from SPSS.

	y_{14}	y_{15}	y_{16}
y_{14}	0.791[a]	-0.297	-0.192
y_{15}	-0.297	0.630[a]	-0.575
y_{16}	-0.192	-0.575	0.646[a]

a. Measures of Sampling Adequacy (MSA)

After adjustments, all communalities from **Table VII**.22 are greater than 0.50, indicating that much of the variance of the manifest items is explained by the [B] factor.

Table VII.22 – Communalities: for [B]. **Source:** Own elaboration from SPSS.

Meaning	Variable	Communalities
Business process	y_{14}	0.588
Projects	y_{15}	0.773
Practices	y_{16}	0.741

According to **Table VII**.23, there is a unique eigenvalue (*Eigenvalue*) greater than 1. Thus, by the latent root criterion, to derive the number of factors, there is a single component to be extracted for these variables.

Table VII.23 – Total Variance Explained for [B], from the extracted components. **Source:** Own elaboration from SPSS.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.102	70.067	70.067	2.102	70.067	***70.067***
2	0.575	19.161	89.228			
3	0.323	10.772	100.000			

Extraction Method: Principal Component Analysis.

Furthermore, the *cumulative proportion of explained variance* ($\geq 60\%$) is satisfied with one component, that is, the solution proposed by *IBM® Statistics SPSS* 20.0 software could explain 70.067% of the total variance. This result can be also displayed graphically in **Figure VII.4**.

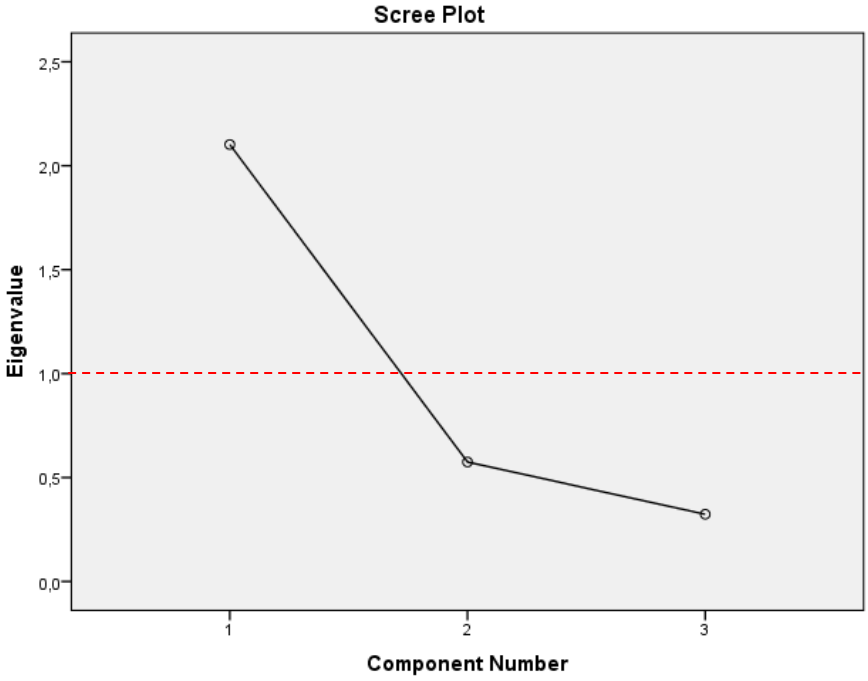


Figure VII.4 – Eigenvalues as a function of the number of components for latent variable [B]. **Source**: Own elaboration from SPSS.

Finally, **Table VII**.24 depicts the factor loadings for each variable. In this case only one component was extracted, and therefore, the solution cannot be rotated.

Table VII.24 – Component Matrix: for [A]. **Source:** Own elaboration from SPSS.

	Component 1[a]
y_{14}	0.767
y_{15}	0.879
y_{16}	0.861

[a] 1 component extracted.

In case of the construct ***Business operations [B]***, the EFA analysis did not generate any adjustment to the model, otherwise, those adjustments would be later incorporated into the redesign of the complete theoretical model.

VII.2.5. EFA for Value delivery [R]

The EFA analysis for the *latent variable* ***Value delivery [R]*** was performed with the three *manifest exogenous variables* from the original model depicted in **Figure 5.13**, i.e., y_{17}, y_{18}, and y_{19}.

The first results analyzed sets out the *KMO* (*Measure of Sampling Adequacy-MSA*) with acceptable value of $0.680 > 0.5$; and a *Bartlett's Test of Sphericity* with *significance* level lesser than 0.001. **Table VII**.25 presents the new KMO values and the Bartlett test depicting the appropriateness of factor analysis to the data sample.

Table VII.25 – KMO and Bartlett's Test: for [R]. **Source:** Own elaboration from SPSS.

Statistical tests and measures		Calculated values
KMO (Measure of Sampling Adequacy-MSA)		0.680
Bartlett's Test of Sphericity	Approx. Chi-Square	121.962
	Degrees of freedom (df)	3
	Significance	0.000

Table VII.26 depicts the *anti-image matrix* with all elements of the main diagonal greater than 0.50.

Table VII.26 – Anti-image Correlation Matrix: for [R]. **Source:** Own elaboration from SPSS.

	y_{17}	y_{18}	y_{19}
y_{17}	0.699[a]	-0.517	-0.135
y_{18}	-0.517	0.631[a]	-0.453
y_{19}	-0.135	-0.453	0.733[a]

a. Measures of Sampling Adequacy (MSA)

After adjustments, all communalities from **Table VII**.27 are greater than 0.50, indicating that much of the variance of the manifest items is explained by the [R] factor.

Table VII.27 – Communalities: for [R]. **Source:** Own elaboration from SPSS.

Meaning	Variable	Communalities
Utility	y_{17}	0.702
Warranty	y_{18}	0.805
Time-to-market	y_{19}	0.668

According to **Table VII**.28, there is a unique eigenvalue (*Eigenvalue*) greater than 1. Thus, by the latent root criterion, to derive the number of factors, there is a single component to be extracted for these variables.

Table VII.28 – Total Variance Explained for [R], from the extracted components. **Source:** Own elaboration from SPSS.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.174	72.482	72.482	2.174	72.482	**72.482**
2	0.517	17.237	89.719			
3	0.308	10.281	100.000			

Extraction Method: Principal Component Analysis.

Furthermore, the *cumulative proportion of explained variance* ($\geq 60\%$) is satisfied with one component, that is, the solution proposed by *IBM® Statistics SPSS* 20.0 software could explain 72.482% of the total variance. This result can be also displayed graphically in **Figure VII.5**.

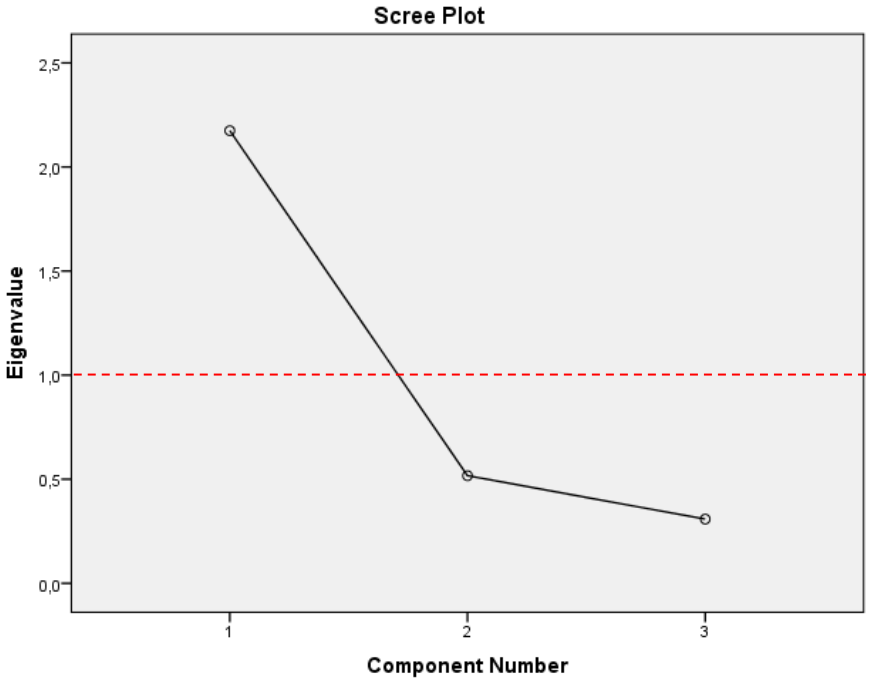


Figure VII.5 – Eigenvalues as a function of the number of components for latent variable [R]. **Source**: Own elaboration from SPSS.

Finally, **Table VII**.29 depicts the factor loadings for each variable. In this case only one component was extracted, and therefore, the solution cannot be rotated.

Table VII.29 – Component Matrix: for [R]. **Source:** Own elaboration from SPSS.

	Component 1[a]
y_{17}	0.838
y_{18}	0.897
y_{19}	0.817

[a] 1 component extracted.

In case of the construct ***Value delivery [R]***, the EFA analysis did not generate any adjustment to the model, otherwise, those adjustments would be later incorporated into the redesign of the complete theoretical model.

APPENDIX VII.3. Confirmatory Factor Analysis (CFA)

For each *latent variable* (construct) of the model derived from the emerging theory depicted in Chapter 4, we have followed the same procedure depicted in Section 5.2.5.1.1. In the following Sections, in short, we will discuss the relevant aspects of the CFA analysis for each remaining construct from model derived of the emerging theory.

VII.3.1. CFA for measurement sub-model of Effects of moderator factors [M]

After the EFA, three manifest variables measure the construct *Effects of moderator factors [M]: Organizational culture refractoriness* (y_1), *Enterprise architecture inadequacy* (y_3), *Business model inadequacy* (y_4), and *Low-skilled people* (y_5). The objective of this stage of modeling is to verify, using CFA, whether the correlational structure of this measurement sub-model reproduces adequately the empirical evidence of the data sample. In order to analyze this matter, we are using the SEM quality indices for model fit described in **Table 2.6**.

The CFA results for this sub-model are depicted in **Figure VII.6**, which corresponds to the screen of the fitted model with the display of standardized estimates (*default model with standardized estimates*) from IBM® SPSS® Amos 20.0.

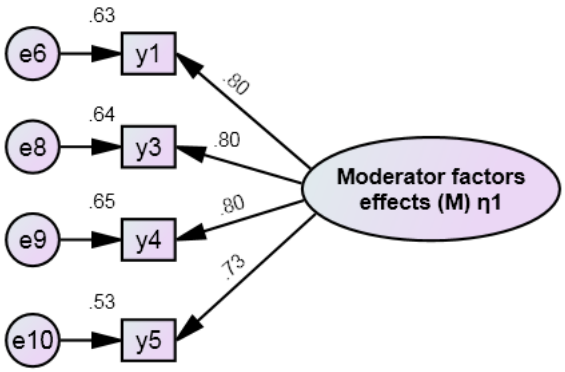


Figure VII.6 – Measurement sub-model: Effects of moderator factors [M]. **Source**: Own elaboration from AMOS.

In **Figure VII.6** all manifest variables have presented high *factor weights* ($\lambda \geq 0.5$), and appropriate *individual reliability* described by the *squared multiple correlations* ($R^2 \geq 0.25$). The measure sub-model demonstrated *good quality fit* as described by the depicted indexes in **Table VII**.30.

Table VII.30 – Adjustment of quality indexes from the measurement sub-model: for [M], ($\boldsymbol{n = 118}$). **Source:** Own elaboration from AMOS.

Indexes →	χ^2	df	**p-value**	χ^2/gl	**CFI**	**GFI**	**TLI**	**RMSEA**	**p(RMESEA≤ 0.05)**
Values obtained	0.893	2	0.640	0.447	1.000	0.996	1.016	0.000	0.714
Reference values	lower is better	≥1	>0.05	<3	>0.90	>0.90	close to 1	<0.10	≥0.05
Analysis	**OK**	**OK**	**OK**	**Good fit**	**Very good fit**	**Very good fit**	**Good fit**	**Very good fit**	**Good fit**

Table VII.31 depicts other estimates calculated for this measurement sub-model. Noteworthy are the *standardized factor weights* (λ) between the latent variable [M] and its manifest variables. In all cases these values are greater than 0.5, demonstrating how the ***Effects of moderator factors [M]*** adequately "*manifest*" themselves by the *empirical indicators* from the theoretical model.

Table VII.31 – CFA results for construct [M], ($\boldsymbol{n = 118}$). **Source:** Own elaboration from AMOS.

Relations and Variables	**Standardized Regression Weights** (λ)	**Standardized Errors** (ε)	p	**Squared Multiple Correlations** (R^2)
$y_1 \leftarrow M$	0.796	0.176	***	-
$y_3 \leftarrow M$	0.799	0.183	***	-
$y_4 \leftarrow M$	0.803	0.189	***	-
$y_5 \leftarrow M$	0.725	0.211	***	-
y_1	-	-	-	0.633
y_3	-	-	-	0.638
y_4	-	-	-	0.645
y_5	-	-	-	0.526

*** p <0.001
N/A: the standard error for calculating this ratio is not applicable, because the non-standard weight was set at 1 to determine the model.

Moreover, the *standardized error* (ε) for each *regression weight* was calculated having their respective *probability* (p) less than 0.001, in all cases. For example, the *regression coefficient* for **[M]** in predicting the "***Organizational culture refractoriness***" **(y_1)** is significantly different from zero at the 0.001 level.

The "***Business model inadequacy***" **(y_4)** of the ***Effects of moderator factors [M]*** is presented as the indicator of greatest impact (factor weight, $\lambda_{y_4} = 0.803$), and the **"*Low-skilled people*" (y_5)** the lowest effect perceived by respondents (factor weight, $\lambda_{y_5} = 0.725$). Additionally, the *square of the standard correlation coefficient* (R^2) measures the portion of variance of each indicator explained by latent factor. For example, **52.6%** from the effect of ***"Low-skilled people"*** **(y_5)** perceived by the ***organizational context*** would be explained by the ***Effects of moderator factors [M]***.

VII.3.2. CFA for measurement sub-model of Agile capabilities [A]

After the EFA, three manifest variables measure the construct *Agile capabilities [A]* upon*: Flexibility* (y_6), *Leanness* (y_7), *Agility* (y_8), and *Adaptability* (y_9). The objective of this stage of modeling is to verify, using CFA, whether the correlational structure of this measurement sub-model reproduces adequately the empirical evidence of the data sample. In order to analyze this matter, we are using the SEM quality indices for model fit described in **Table 2.6**.

The CFA results for this sub-model are depicted in **Figure VII.7**, which corresponds to the screen of the fitted model with the display of standardized estimates (*default model with standardized estimates*) from IBM® SPSS® Amos 20.0.

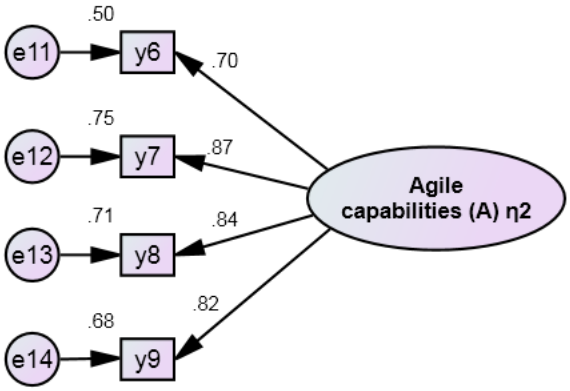


Figure VII.7 – Measurement sub-model: Agile capabilities [A]. **Source**: Own elaboration from AMOS.

In **Figure VII.7** all manifest variables have presented high *factor weights* ($\lambda \geq 0.5$), and appropriate *individual reliability* described by the *squared multiple correlations* ($R^2 \geq 0.25$). The measure sub-model demonstrated *good quality fit* as described by the indexes depicted in **Table VII**.32.

Table VII.32 – Adjustment of quality indexes from the measurement sub-model: for [A], ($\boldsymbol{n = 118}$). **Source:** Own elaboration from AMOS.

Indexes →	χ^2	df	**p-value**	χ^2/gl	**CFI**	**GFI**	**TLI**	**RMSEA**	**p(RMESEA≤ 0.05)**
Values obtained	0.692	2	0.708	0.346	1.000	0.997	1.016	0.000	0.771
Reference values	lower is better	≥1	>0.05	<3	>0.90	>0.90	close to 1	<0.10	≥0.05
Analysis	**OK**	**OK**	**OK**	**Good fit**	**Very good fit**	**Very good fit**	**Good fit**	**Very good fit**	**Good fit**

Table VII.33 depicts other estimates calculated for this measurement sub-model. Noteworthy are the *standardized factor weights* (λ) between the latent variable [A] and its manifest variables. In all cases these values are greater than 0.5, demonstrating how the ***Agile***

capabilities [A] adequately "*manifest*" themselves by the *empirical indicators* from the theoretical model.

Table VII.33 – CFA results for construct [A], ($\boldsymbol{n = 118}$). **Source:** Own elaboration from AMOS.

Relations and Variables	Standardized Regression Weights (λ)	Standardized Errors (ε)	p	Squared Multiple Correlations (R^2)
$\boldsymbol{y_6} \leftarrow \boldsymbol{M}$	0.705	0.190	***	-
$\boldsymbol{y_7} \leftarrow \boldsymbol{M}$	0.867	0.153	***	-
$\boldsymbol{y_8} \leftarrow \boldsymbol{M}$	0.844	0.161	***	-
$\boldsymbol{y_9} \leftarrow \boldsymbol{M}$	0.823	0.150	***	-
$\boldsymbol{y_6}$	-	-	-	0.497
$\boldsymbol{y_7}$	-	-	-	0.752
$\boldsymbol{y_8}$	-	-	-	0.713
$\boldsymbol{y_9}$	-	-	-	0.677

*** p <0.001
N/A: the standard error for calculating this ratio is not applicable, because the non-standard weight was set at 1 to determine the model.

Moreover, the *standardized error* (ε) for each *regression weight* was calculated having their respective *probability* (p) less than 0.001, in all cases. For example, the *regression coefficient* for **[A]** in predicting the "***Agility perspicacity***" **($\boldsymbol{y_8}$)** is significantly different from zero at the 0.001 level.

The **"*Leanness adeptness*" ($\boldsymbol{y_7}$)** of the ***Agile capabilities [A]*** is presented as the indicator of greatest impact (factor weight, $\lambda_{y_7} = 0.867$), and the "***Flexibility dexterity***" **($\boldsymbol{y_6}$)** the lowest effect perceived by respondents (factor weight, $\lambda_{y_6} = 0.705$). Additionally, the *square of the standard correlation coefficient* (R^2) measures the portion of variance of each indicator explained by latent factor. For example, **67.7%** from the effect of "***Adaptability proficiency***" **($\boldsymbol{y_9}$)** perceived by the ***organizational context*** would be explained by the ***Agile capabilities [A]***.

VII.3.3. CFA for measurement sub-model of Governance capabilities [G]

After the EFA, three manifest variables measure the construct Governance capabilities [G] on: *Strategic alignment* ($\boldsymbol{y_{10}}$), *Decision making* ($\boldsymbol{y_{11}}$), and *Control* ($\boldsymbol{y_{12}}$). The objective of this stage of modeling is to verify, using CFA, whether the correlational structure of this measurement sub-model reproduces adequately the empirical evidence of the data sample. In order to analyze this matter, we are using the SEM quality indices for model fit described in **Table 2.6**.

In the first attempt, the measurement sub-model did not present a good adjustment, then, following the suggestions from Marôco (2014) we adopt the strategy to analyze the "*Modification Indices*" based on the CFA results data processed by IBM® SPSS® Amos 20.0. As a

consequence we proceeded to correlate the measurement errors from variables $\boldsymbol{y_{10}}$, $\boldsymbol{y_{11}}$ and $\boldsymbol{y_{12}}$. Follows the analysis for each standardized correlation coefficient, in keeping with Kline (2011):

i. The standardized correlation coefficient between the errors from $\boldsymbol{y_{10}}$ and $\boldsymbol{y_{11}}$ was 0.542. It can be interpreted as the existence of a factor (another manifest variable to measure the value of [G]), not included in the model, affecting these two variables equally strong, in the same direction. From a theoretical point of view, greater S*trategic alignment* capability would cause greater ability to perform *Decision making*.

ii. The standardized correlation coefficient between the errors from $\boldsymbol{y_{11}}$ and $\boldsymbol{y_{12}}$ was 0.503. It can be interpreted as the existence of a factor, not included in the model, affecting these two variables equally strong, in the same direction. From a theoretical point of view, greater *Decision making* capability would cause greater ability to perform *Control* upon organizational achievements.

iii. The standardized correlation coefficient between the errors from $\boldsymbol{y_{10}}$ and $\boldsymbol{y_{12}}$ was 0.433. It can be interpreted as the existence of a factor, not included in the model, affecting these two variables equally strong, in the same direction. From a theoretical point of view, greater S*trategic alignment* capability would cause greater ability to perform *Control* upon organizational achievements.

We would infer, that the existence of factor(s), not included in the model, affecting these variables can be, e.g., a consequence of removal of the manifest variable *Compliance* ($\boldsymbol{y_{13}}$) during the EFA analysis. At that analysis stage, we have removed *Compliance* ($\boldsymbol{y_{13}}$) from the model because the *communality value* for y_{13} (0.464) was lesser than 0.5. We recognize that such small representation for this variable ($\boldsymbol{y_{13}}$), based on our survey data results, may have been given due to the combination of: (1) cultural issues of how this variable is perceived by the people; (2) *haziness* in our own data collection instrument (questionnaire) in terms of how we have addressed that concept.

On the other hand, we would imply, as we have discussed in the Section 4.4.2, which the set of empirical indicators adopted to carry on this kind of empirical assessment can (and should) be adjusted according the organizational context studied. In other words, some "absent" factor from the model under analysis would be the consequence of a data collect instrument was not specific enough, reflecting in the quality of data gathered. This current experience in

conducting this survey, lead us to believe that how much more specific are the empirical indicators (manifest variables) chosen, the better will be the result of the study. Usually, the set of indicators identified in this study can a useful reference for future work on this topic.

The CFA results for this sub-model are depicted in **Figure VII.8**, which corresponds to the screen of the fitted model with the display of standardized estimates (Default model with standardized Estimates) from IBM® SPSS® Amos 20.0.

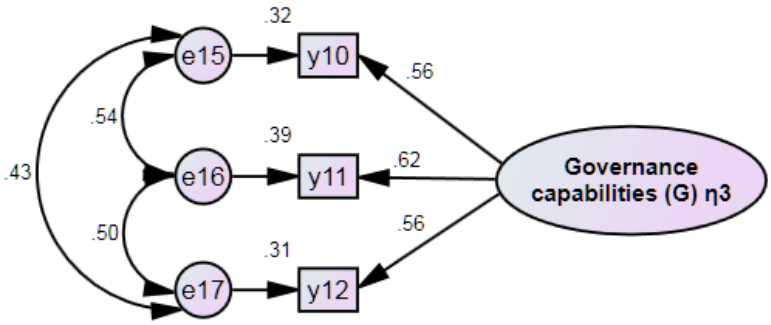


Figure VII.8 – Measurement sub-model: Governance capabilities [G]. **Source**: Own elaboration from AMOS.

In **Figure VII.8** all manifest variables have presented high *factor weights* ($\lambda \geq 0.5$), and appropriate *individual reliability* described by the *squared multiple correlations* ($R^2 \geq 0.25$). The measure sub-model demonstrated *good quality fit* as described by the indexes depicted in **Table VII**.36.

Table VII.34 – Adjustment of quality indexes from the measurement sub-model: for [G], ($\boldsymbol{n = 118}$). **Source:** Own elaboration from AMOS.

Indexes →	χ^2	df	p-value	χ^2/gl	CFI	GFI	TLI	RMSEA	p(RMESEA≤ 0.05)
Values obtained	0.740	1	0.390	0.740	1.000	0.996	1.005	0.000	0.455
Reference values	lower is better	≥1	>0.05	<3	>0.90	>0.90	close to 1	<0.10	≥0.05
Analysis	**OK**	**OK**	**OK**	**Good fit**	**Very good fit**	**Very good fit**	**Good fit**	**Very good fit**	**Good fit**

Table VII.35 depicts other estimates calculated for this measurement sub-model. Noteworthy are the *standardized factor weights* (λ) between the latent variable [G] and its manifest variables. In all cases these values are greater than 0.5, demonstrating how the ***Governance capabilities [G]*** adequately "*manifest*" themselves by the *empirical indicators* from the theoretical model.

Table VII.35 – CFA results for construct [G], ($\boldsymbol{n = 118}$). **Source:** Own elaboration from AMOS.

Relations and Variables	Standardized Regression Weights (λ)	Standardized Errors (ε)	p	Squared Multiple Correlations (R^2)
$y_{10} \leftarrow G$	0.564	N/A	N/A	-
$y_{11} \leftarrow G$	0.624	0.163	***	-
$y_{12} \leftarrow G$	0.558	0.198	***	-
y_{10}	-	-	-	0.318
y_{11}	-	-	-	0.389
y_{12}	-	-	-	0.311

*** p <0.001
N/A: the standard error for calculating this ratio is not applicable, because the non-standard weight was set at 1 to determine the model.

Moreover, the *standardized error* (ε) for each *regression weight* was calculated having their respective *probability* (p) less than 0.001, in all cases. For example, the *regression coefficient* for **[G]** in predicting the **"*Control competency*"** ($\boldsymbol{y_{12}}$) is significantly different from zero at the 0.001 level.

The **"*Decision making proficiency*"** ($\boldsymbol{y_{11}}$) of the ***Governance capabilities [G]*** is presented as the indicator of greatest impact (factor weight, $\lambda_{y_{11}} = 0.624$), and the **"*Strategic alignment ability*"** ($\boldsymbol{y_{10}}$) the lowest effect perceived by respondents (factor weight, $\lambda_{y_{10}} = 0.564$). Additionally, the *square of the standard correlation coefficient* (R^2) measures the portion of variance of each indicator explained by latent factor. For example, **38.9%** from the effects of **"*Decision making proficiency*"** ($\boldsymbol{y_{11}}$) perceived by the ***organizational context*** would be explained by the ***Governance capabilities [G]***.

VII.3.4. CFA for measurement sub-model of Business operations [B]

After the EFA, three manifest variables measure the construct Business operations [B]: *"Business process driven approach"* ($\boldsymbol{y_{14}}$), "*Projects driven approach"* ($\boldsymbol{y_{15}}$), and *"Best practices adoption"* ($\boldsymbol{y_{16}}$). The objective of this stage of modeling is to verify, using CFA, whether the correlational structure of this measurement sub-model reproduces adequately the empirical evidence of the data sample. In order to analyze this matter, we are using the SEM quality indices for model fit described in **Table 2.6**.

The CFA results for this sub-model are depicted in **Figure VII.9**, which corresponds to the screen of the fitted model with the display of standardized estimates (Default model with standardized Estimates) from IBM® SPSS® Amos 20.0.

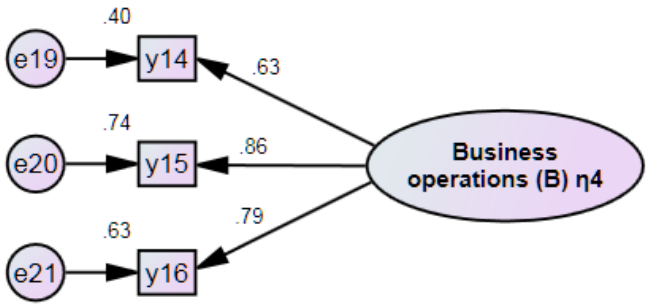


Figure VII.9 – Measurement sub-model: Business operations [B]. **Source**: Own elaboration from AMOS.

In **Figure VII.9** all manifest variables have presented high *factor weights* ($\lambda \geq 0.5$), and appropriate *individual reliability* described by the *squared multiple correlations* ($R^2 \geq 0.25$). The measure sub-model demonstrated *good quality fit* as described by the indexes depicted in **Table VII**.36.

Table VII.36 – Adjustment of quality indexes from the measurement sub-model: for [B], ($\boldsymbol{n = 118}$). **Source:** Own elaboration from AMOS.

Indexes →	χ^2	df	**p-value**	χ^2/gl	**CFI**	**GFI**	**TLI**	**RMSEA**	**p(RMSEA≤ 0.05)**
Values obtained	0.433	1	0.511	0.433	1.000	0.998	1.016	0.000	0.569
Reference values	lower is better	≥1	>0.05	<3	>0.90	>0.90	close to 1	<0.10	≥0.05
Analysis	**OK**	**OK**	**OK**	**Very good fit**	**Very good fit**	**Very good fit**	**Good fit**	**Very good fit**	**Good fit**

Table VII.37 depicts other estimates calculated for this measurement sub-model. Noteworthy are the *standardized factor weights* (λ) between the latent variable [B] and its manifest variables. In all cases these values are greater than 0.5, demonstrating how the ***Business operations [B]*** adequately "*manifest*" themselves by the *empirical indicators* from the theoretical model.

Table VII.37 – CFA results for construct [B], ($\boldsymbol{n = 118}$). **Source:** Own elaboration from AMOS.

Relations and Variables	**Standardized Regression Weights (λ)**	**Standardized Errors (ε)**	p	**Squared Multiple Correlations (R^2)**
$y_{14} \leftarrow B$	0.632	N/A	N/A	-
$y_{15} \leftarrow B$	0.858	0.154	***	-
$y_{16} \leftarrow B$	0.792	0.140	***	-
y_{14}	-	-	-	0.400
y_{15}	-	-	-	0.736
y_{16}	-	-	-	0.628

*** p <0.001
N/A: the standard error for calculating this ratio is not applicable, because the non-standard weight was set at 1 to determine the model.

Moreover, the *standardized error* (ε) for each *regression weight* was calculated having their respective *probability* (p) less than 0.001, in all cases. For example, the *regression coefficient*

for **[B]** in predicting the **"*Best practices adoption*"** ($\boldsymbol{y_{16}}$) is significantly different from zero at the 0.001 level.

The **"*Projects driven approach*"** ($\boldsymbol{y_{15}}$) of the ***Business operations [B]*** is presented as the indicator of greatest impact (factor weight, $\lambda_{y_{15}} = 0.858$), and the **"*Business process driven approach*"** ($\boldsymbol{y_{14}}$) the lowest effect perceived by respondents (factor weight, $\lambda_{y_{14}} = 0.632$). Additionally, the *square of the standard correlation coefficient* (R^2) measures the portion of variance of each indicator explained by latent factor. For example, $\mathbf{73.6\%}$ from the effects of **"*Projects driven approach*"** ($\boldsymbol{y_{15}}$) perceived by the ***organizational context*** would be explained by the ***Business operations [B]***.

VII.3.5. CFA for measurement sub-model of Value delivery [R]

After the EFA, three manifest variables measure the construct Value delivery [R]: *"the grade of **Utility** embedded in products or services"* ($\boldsymbol{y_{17}}$), "*the grade of **Warranty** embedded in products or services"* ($\boldsymbol{y_{18}}$), and *"**Time-to-market** to release and maintain those products or services"* ($\boldsymbol{y_{19}}$). The objective of this stage of modeling is to verify, using CFA, whether the correlational structure of this measurement sub-model reproduces adequately the empirical evidence of the data sample. In order to analyze this matter, we are using the SEM quality indices for model fit described in **Table 2.6**.

In the first attempt, the measurement sub-model did not present a good adjustment. Then, following the suggestions from Marôco (2014) we adopt the strategy to analyze the "*Modification Indices*" based on the CFA results data processed by IBM® SPSS® Amos 20.0. As a consequence we proceeded to correlate the measurement errors from variables $\boldsymbol{y_{17}}$ and $\boldsymbol{y_{18}}$. Follows the analysis for each standardized correlation coefficient, in keeping with Kline (2011): The standardized correlation coefficient between the errors from $\boldsymbol{y_{17}}$ and $\boldsymbol{y_{18}}$ was 0.440. It can be interpreted as the existence of a factor (another manifest variable to measure the value of [R]), not included in the model, affecting these two variables equally strong, in the same direction. From a theoretical point of view, greater *Utility* embedded in products or services would result in greater *Warranty* for the same ones.

Considering the existing theoretical reference about the correlation of these concepts, this adjustment strategy really makes sense. For instance, according to ITIL v3 (OGC, 2007c), from the customer's perspective, value consists of two primary elements: utility or fitness for purpose and warranty or fitness for use. **Utility** is perceived by the customer from the attributes of the service that have a positive effect on the performance of tasks associated with desired outcomes. Removal or relaxation of constraints on performance is also perceived as a positive effect. In complement, **warranty** is derived from the positive effect being available when needed, in sufficient capacity or magnitude, and dependably in terms of continuity and security.

Utility is what the customer gets, and *warranty* is how it is delivered. Customers cannot benefit from something that is fit for purpose but not fit for use, and vice versa. As depicted in **Figure VII.10**, it is useful to separate the logic of utility from the logic of warranty for the purpose of design, development and improvement. Considering all the separate controllable inputs allows for a wider range of solutions to the problem of creating, maintaining and increasing value.

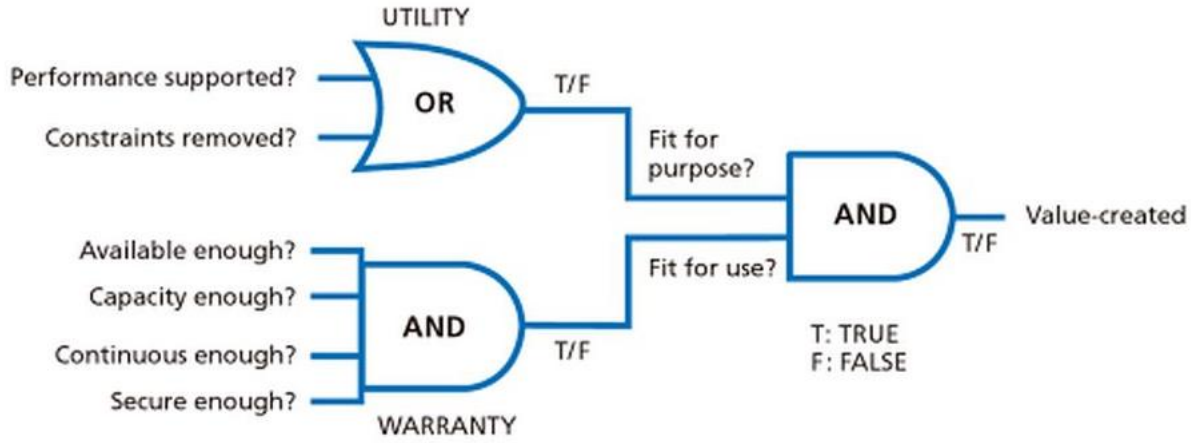


Figure VII.10 – Combining utility and warranty for value creation. **Source**: (OGC, 2007c).

The CFA results for this sub-model are depicted in **Figure VII.11**, which corresponds to the screen of the fitted model with the display of standardized estimates (Default model with standardized Estimates) from IBM® SPSS® Amos 20.0.

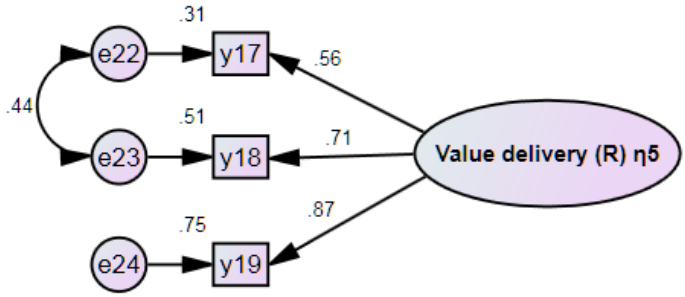


Figure VII.11 – Measurement sub-model: Value delivery [R]. **Source**: Own elaboration from AMOS.

In **Figure VII.11** all manifest variables have presented high *factor weights* ($\lambda \geq 0.5$), and appropriate *individual reliability* described by the *squared multiple correlations* ($R^2 \geq 0.25$). The measure sub-model demonstrated *good quality fit* as described by the indexes depicted in **Table VII**.38.

Table VII.38 – Adjustment of quality indexes from the measurement sub-model: for [R], ($\boldsymbol{n = 118}$). **Source:** Own elaboration from AMOS.

Indexes →	χ^2	df	p-value	χ^2/df	CFI	GFI	TLI	RMSEA	p(RMESEA≤ 0.05)
Values obtained	0.001	1	0.974	0.001	1.000	1.000	1.025	0.000	0.977
Reference values	lower is better	≥1	>0.05	<3	>0.90	>0.90	close to 1	<0.10	≥0.05
Analysis	**OK**	**OK**	**OK**	**Very good fit**	**Very good fit**	**Very good fit**	**Good fit**	**Very good fit**	**Very good fit**

Table VII.39 depicts other estimates calculated for this measurement sub-model. Noteworthy are the *standardized factor weights* (λ) between the latent variable [R] and its manifest variables. In all cases these values are greater than 0.5, demonstrating how the ***Value delivery [R]*** adequately "*manifest*" themselves by the *empirical indicators* from the theoretical model.

Table VII.39 – CFA results for construct [R], ($\boldsymbol{n = 118}$). **Source:** Own elaboration from AMOS.

Relations and Variables	Standardized Regression Weights (λ)	Standardized Errors (ε)	p	Squared Multiple Correlations (R^2)
$y_{17} \leftarrow R$	0.558	N/A	N/A	-
$y_{18} \leftarrow R$	0.713	0.177	***	-
$y_{19} \leftarrow R$	0.866	0.219	***	-
y_{17}	-	-	-	0.312
y_{18}	-	-	-	0.508
y_{19}	-	-	-	0.749

*** p <0.001
N/A: the standardized error for calculating this ratio is not applicable, because the non-standard weight was set at 1 to determine the model.

Moreover, the *standardized error* (ε) for each *regression weight* was calculated having their respective *probability* (p) less than 0.001, in all cases. For example, the *regression coefficient* for **[E]** in predicting the ***"Warranty"*** (y_{18}) is significantly different from zero at the 0.001 level.

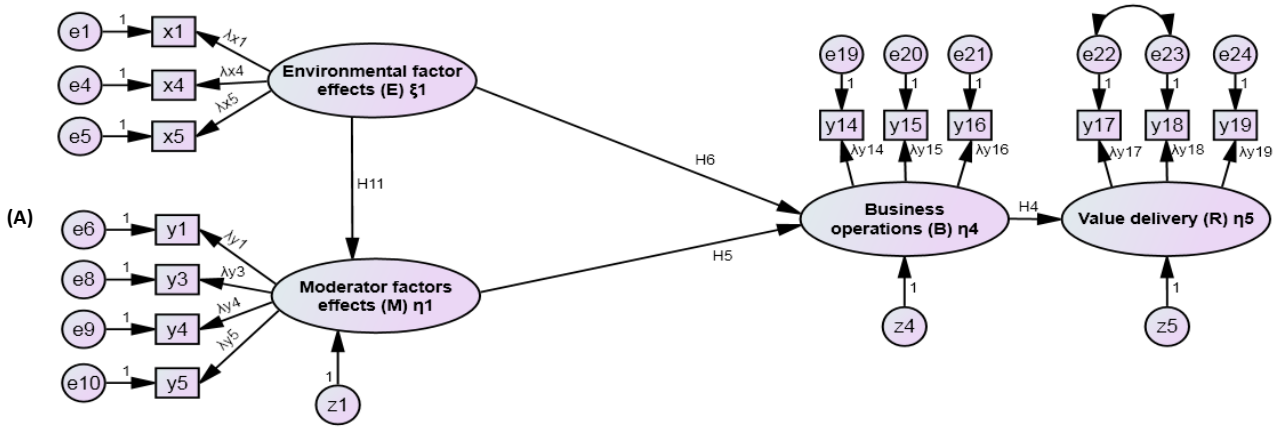
The **"*Time-to-market*"** ($\boldsymbol{y_{19}}$) of the ***Value delivery [R]*** is presented as the indicator of greatest impact (factor weight, $\lambda_{y_{19}} = 0.866$), and the **"*Utility*"** ($\boldsymbol{y_{17}}$) the lowest effect perceived by respondents (factor weight, $\lambda_{y_{17}} = 0.558$). Additionally, the *square of the standard correlation coefficient* (R^2) measures the portion of variance of each indicator explained by latent factor. For example, **74.9%** from the effects of **"*Time-to-market*"** ($\boldsymbol{y_{19}}$) perceived by the ***organizational context*** would be explained by the ***Value delivery [R]***.

APPENDIX VII.4. Theoretical Scenarios: validity analysis (models estimation and Hypotheses testing)

After checking the reliability and validity of the measuring instrument (Section 5.2.5.2.2), in the following sections, we will proceed to estimate the full model and the confirmation or rejection of the causal hypotheses to the phenomena under study, in every theoretical scenario from the emerging theory, depicted in **Figure 4.14**, and disscussed in Section **4.5.3**.

VII.4.1. Beginners Scenario (φ_0)

From the model based on **Beginners Scenario (φ_0)**, adjusted after EFA, and depicted in **Figure VII.12.(A)**, we have performed the estimation of the complete model (measurement sub-model + structural sub-model) with the aid of *IBM SPSS Amos 20.0* software, using the bootstrap procedure with 2000 resampling. The results of the estimation for the complete model are depicted in **Figure VII.12.(B)**.



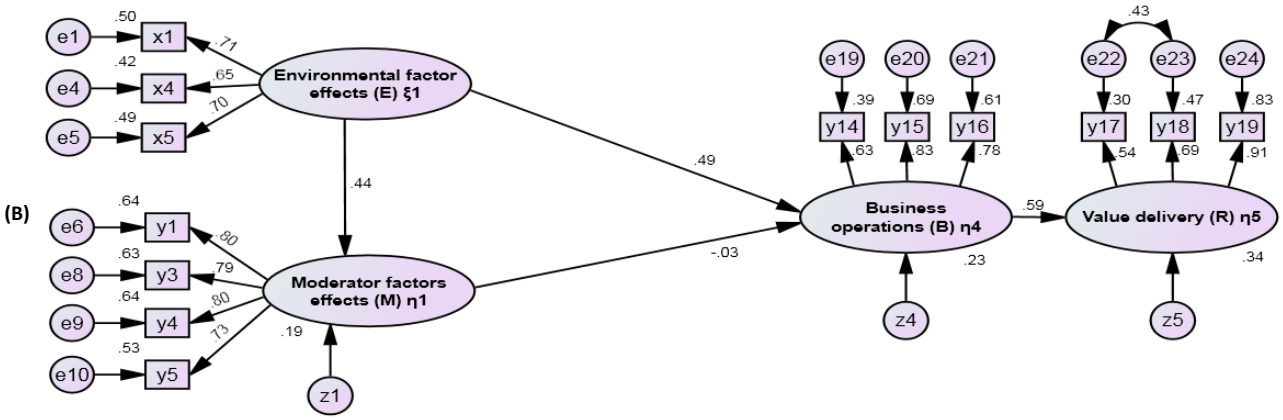


Figure VII.12 – (A) Theoretical model of structural equations based on *Beginners Scenario* (φ_0). **(B)** Estimated model of structural equations with standardized weights for (φ_0), ($n = 118$). **Source**: Own elaboration.

The ***discriminant validity*** from the constructs for Beginners Scenario (φ_0) is depicted in **Table VII**.40. In fact, the results have confirmed the *discriminant validity* for each construct that is present in the current theoretical scenario.

Table VII.40 – Discriminant validity from the constructs for Beginners Scenario (φ_0), ($\boldsymbol{n = 118}$). **Source:** Own elaboration.

$i \leftarrow j$	Φ_{ij}	Φ_{ij}^2	AVE_i	AVE_j	$AVE_i \wedge AVE_j \geq \Phi_{ij}^2$?
M ← E	0.438	0.192	0.870	0.781	OK
B ← E	0.494	0.244	0.786	0.781	OK
B ← M	-0.027	0.001	0.786	0.870	OK
R ← B	0.585	0.342	0.714	0.786	OK

On the other hand, from the table values of *Squared Multiple Correlations* calculated by IBM® SPSS® Amos, was elaborated a summary depicted in **Table VII**.41 for all endogenous latent variables of the model.

Table VII.41 – Variance explained by endogenous latent constructs for Beginners Scenario (φ_0), ($\boldsymbol{n = 118}$). Source: Own elaboration from AMOS.

Endogenous latent variables	% of explained variance by the model
Effects of moderator factors [M]	19.2
Business operations [B]	23.3
Value delivery [R]	34.2

We found that 23.3% of the variance of Business operations [B] and 34.2% of the variance of Value delivery [R] can be explained by the model proposed for Beginners Scenario (φ_0). It is a low explanatory power, for less than half of both constructs can be measured by changes in the constructs included in the modeling, the remaining variance (76.7% and 65.8%, respectively for [B] and [R]) is attributed to factors not considered in the model depicted for this scenario. However, a result of this nature would be expected for an initial scenario, where many of

theory constructs are absent, and the degree of "***organizational entropy***"[83] is the largest possible.

We have correlated the errors from the manifest variables $\boldsymbol{y_{17}}$ and $\boldsymbol{y_{18}}$ in order to improve the goodness fit indices of the SEM model, as already discussed and justified during CFA analysis, in Section VII.3.5. This adjustment strategy, once supported by theory, literature, or evidences gathered from field study, it is good practice for SEM model refinement. After that, the SEM model which describes the current scenario has assumed *good fit indices*, and can be described in terms of *overall good quality adjustment indices*. The ***quality adjustment indices*** for the current scenario are depicted in **Table VII**.42, as well as the test for each hypothesis depicted in this scenario is available at **Table VII**.43.

Table VII.42 – Quality adjustment indices from model based on Beginners Scenario (φ_0), ($\boldsymbol{n = 118}$). **Source:** Own elaboration from AMOS.

Group Analysis	Indices	Obtained values	Reference values for Analysis	Analysis
Fit tests	*Chi-square* ***(χ^2)***	58.980	lower is better	-
	Degrees of freedom ***(df)***	61	≥1	OK
	p-value	0.549	>0.05	OK
Absolute Indices	*Standardized Chi-square* ***(χ^2/df)***	0.967	<3	OK
	Root Mean Square Error of Approximation ***(RMSEA)***	0.000	<0.10	Good fit
	Goodness of Fit Index ***(GFI)***	0.928	>0.90	Good fit
Relative Indices	*Comparative Fit Index* ***(CFI)***	1.000	>0.90	Good fit
	Normed Fit Index ***(NFI)***	0.907	>0.90	Good fit
	Tucker-Lewis Index ***(TLI)***	1.005	>0.90	Good fit
Parcimony Indices	*Parsimony GFI* ***(PGFI)***	0.622	>0.60	Good fit
	Parsimony CFI ***(PCFI)***	0.782	>0.60	Good fit
	Parsimony NFI ***(PNFI)***	0.710	>0.60	Good fit
		Solution is admissible	-	Good Fit

Regards to the ***hypotheses testing***, in the scenario under analysis there are only four hypotheses from 16 hypotheses depicted from the emerging theory, which we intend to test. According to the results depicted in **Table VII**.43, only the hypothesis $\boldsymbol{H_5}$ cannot be confirmed ($\beta_{H_5} = -0.027,\ p_{H_5} = 0.823$), because the probability of getting a critical ratio as large as 0.239, in absolute value is 0.811. In other words, the regression weight for [M] in the prediction of [B] is not significantly different from zero at the 0.05 level (two-tailed). Hence, analyzing the current scenario, based on the data sample gathered by this empirical study, we

[83] Entropy is an abstract concept. It refers to a measure of disorder or uncertainty in a system. Martínez-Berumen et al. (2014) discuss the origins of this concept, its implementation in different knowledge areas, and describe the research currently conducted by them to evaluate entropy as a measure of disorder in organizational systems.

cannot substantiate that "*the effects of moderator factors [M] have a negative influence on business operations [B]*" in the **Beginners Scenario (φ_0)** with enough statistical significance. On the other hand, the remaining hypotheses in this scenario were confirmed: $\boldsymbol{H_4}$, $\boldsymbol{H_6}$, and $\boldsymbol{H_{11}}$.

Table VII.43 – Hypothesis test for Beginners Scenario (φ_0), ($\boldsymbol{n = 118}$). **Source:** Own elaboration from AMOS.

Hypotheses		Beginner Scenario (φ_0)	Test	Comments
H_1	Agile governance $[G \leftarrow A]$	N/A	N/A	N/A
H_2	Agile governance $[B \leftarrow G]$	N/A	N/A	N/A
H_3	Specific agility $[B \leftarrow A]$	N/A	N/A	N/A
H_4	Value delivery $[R \leftarrow B]$	Significant ($\beta = 0.585$, ***)	Confirmed	N/A
H_5	Moderator factors effects $[B \leftarrow M]$	Non-significant ($\beta = -0.027$, $p = 0.823$)	Not confirmed	Despite we can identify the negative influence from [M] upon [B] in current scenario, the hypothesis was not enough statistical significant.
H_6	Environmental factors effects $[B \leftarrow E]$	Significant ($\beta = 0.494$, $p = 0.002$ **)	Confirmed	In spite of the hypothesis having statistical significance, the influence identified from [E] upon [B] by the study is positive. In fact, when we realize that not only threats (negative influence) from Environmental factors effects [E] can jeopardize Business operations [B], but also opportunities (positive influence) can potentiate it. This evidence is supported by the emerging theory.
H_7	Moderator factors effects $[A \leftarrow M]$	N/A	N/A	N/A
H_8	Moderator factors effects $[G \leftarrow M]$	N/A	N/A	N/A
H_9	Environmental Factors effects $[A \leftarrow E]$	N/A	N/A	N/A
H_{10}	Environmental factors effects $[G \leftarrow E]$	N/A	N/A	N/A
H_{11}	Environmental factors effects $[M \leftarrow E]$	Significant ($\beta = 0.438$, ***)	Confirmed	N/A
H_{12}	Sustainability $[M \leftarrow A]$	N/A	N/A	N/A
H_{13}	Competitiveness $[E \leftarrow A]$	N/A	N/A	N/A
H_{14}	Sustainability $[M \leftarrow G]$	N/A	N/A	N/A
H_{15}	Competitiveness $[E \leftarrow G]$	N/A	N/A	N/A
H_{16}	Agile Governance mediation $\begin{bmatrix} A & & \\ \downarrow & \searrow & \\ G & \rightarrow & B \end{bmatrix}$	N/A	N/A	N/A
	Statistics	**Passed**: 3/4 **Refuted**:1/4	-	-
	Analysis	75% success	-	-

VII.4.2. Governance experience Scenario (φ_1)

From the model based on **Governance experience Scenario (φ_1)**, adjusted after EFA, and depicted in **Figure VII.13.(A)**, we have performed the estimation of the complete model (measurement sub-model + structural sub-model) with the aid of *IBM SPSS Amos 20.0* software, using the bootstrap procedure with 2000 resampling. The results of the estimation for the complete model are depicted in **Figure VII.13.(B)**.

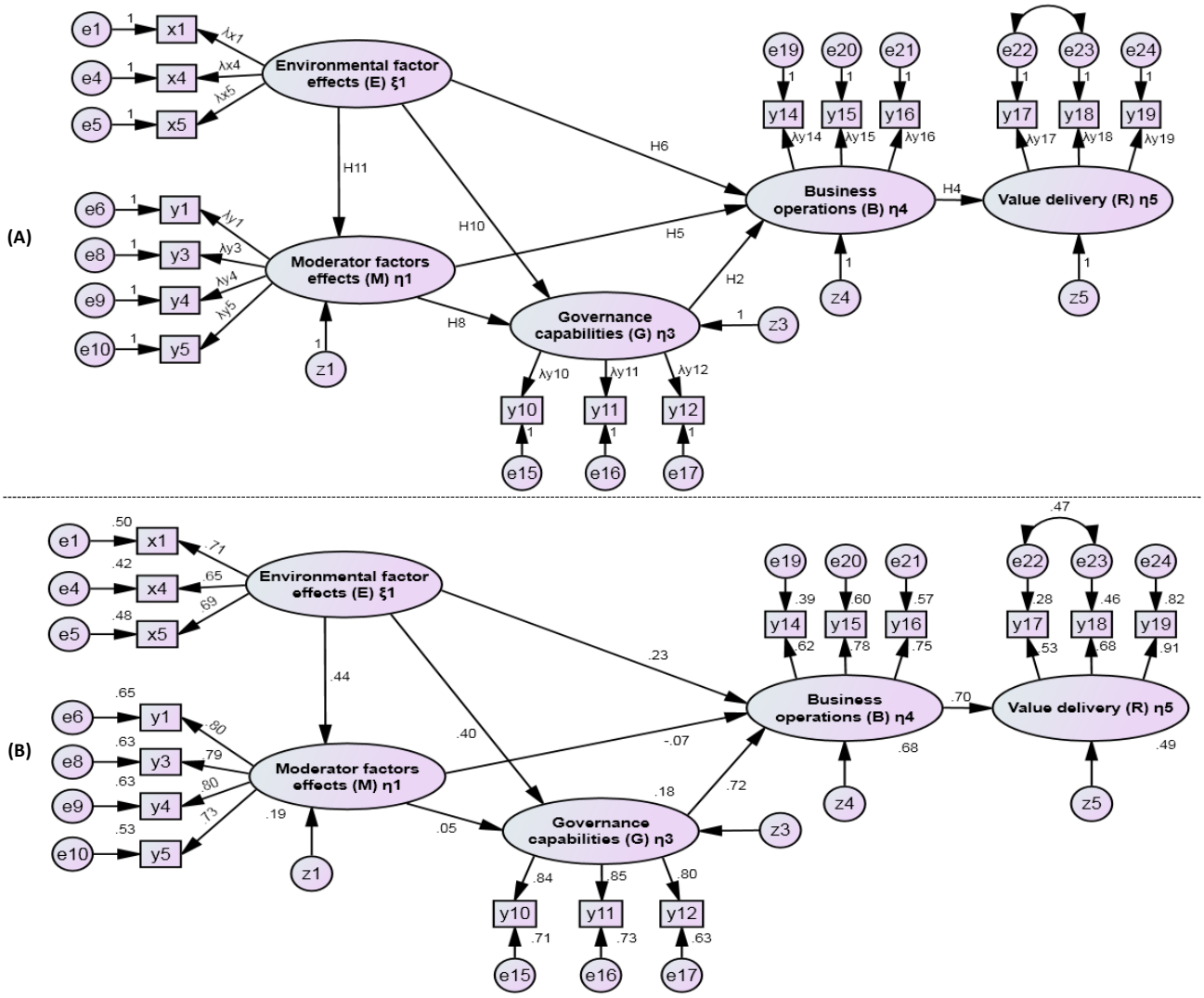


Figure VII.13 – **(A)** Theoretical model of structural equations based on *Governance experience Scenario* (φ_1). **(B)** Estimated model of structural equations with standardized weights for (φ_1), ($n = 118$). **Source**: Own elaboration.

The ***discriminant validity*** from the constructs for Governance experience Scenario (φ_1) is depicted in **Table VII**.44. In fact, the results have confirmed the *discriminant validity* for each construct that is present in the current theoretical scenario.

Table VII.44 – Discriminant validity from the constructs for Governance experience Scenario (φ_1), ($\boldsymbol{n = 118}$). **Source:** Own elaboration.

$i \leftarrow j$	Φ_{ij}	Φ_{ij}^2	AVE_i	AVE_j	$AVE_i \wedge AVE_j \geq \Phi_{ij}^2$?
M ← E	0.438	0.192	0.870	0.781	OK
G ← M	0.050	0.003	0.916	0.870	OK
G ← E	0.403	0.162	0.916	0.781	OK
B ← G	0.720	0.518	0.786	0.916	OK
B ← E	0.232	0.054	0.786	0.781	OK
B ← M	-0.071	0.005	0.786	0.870	OK
R ← B	0.702	0.493	0.714	0.786	OK

On the other hand, from the table values of *Squared Multiple Correlations* calculated by IBM® SPSS® Amos, was elaborated a summary depicted in **Table VII**.45 for all endogenous latent variables of the model.

Table VII.45 – Variance explained by endogenous latent constructs for Governance experience Scenario (φ_1), ($\boldsymbol{n = 118}$). Source: Own elaboration from AMOS.

Endogenous latent variables	% of explained variance by the model
Effects of moderator factors [M]	19.2
Governance capabilities [G]	18.3
Business operations [B]	68.0
Value delivery [R]	49.3

We have found that only 68.0% of the variation of Business operations [B] and 49.3% of the variance of Value delivery [R] can be explained by the model proposed for Governance experience Scenario (φ_1). It is a high explanatory power, for more than half of business operations [B], as well as for almost half of value delivery [R], can be measured by changes in the constructs included in the modeling, the remaining variance (32.0% and 50.7%, respectively for [B] and [R]) is attributed to factors not considered in the model depicted for this scenario.

We have used the same adjustment strategy adopted in previous scenarios, correlating the errors from the manifest variables $\boldsymbol{y_{17}}$ and $\boldsymbol{y_{18}}$ in order to improve the goodness fit indices of the SEM model. After that, the SEM model which describes the current scenario has assumed *acceptable fit indices*, and can be described in terms of *overall acceptable quality adjustment indices*, as already discussed in Section 5.2.5.2.1. The ***quality adjustment indices*** for the current scenario are depicted in **Table VII**.46, as well as the test for each hypothesis depicted in this scenario is available at **Table VII**.47.

Table VII.46 – Quality adjustment indices from model based on Governance experience Scenario (φ_1), ($\boldsymbol{n = 118}$). **Source:** Own elaboration from AMOS.

Group Analysis	Indices	Obtained values	Reference values for Analysis	Analysis
Fit tests	*Chi-square* ***(χ^2)***	142.640	lower is better	-
	Degrees of freedom ***(df)***	96	≥1	OK
	p-value	0.001	>0.05	Acceptable fit
Absolute Indices	*Standardized Chi-square* ***(χ^2/df)***	1.486	<3	OK
	Root Mean Square Error of Approximation ***(RMSEA)***	0.064	<0.10	Good fit
	Goodness of Fit Index ***(GFI)***	0.874	>0.90	Acceptable fit
Relative Indices	*Comparative Fit Index* ***(CFI)***	0.945	>0.90	Good fit
	Normed Fit Index ***(NFI)***	0.852	>0.90	Acceptable fit
	Tucker-Lewis Index ***(TLI)***	0.931	>0.90	Good fit
Parcimony Indices	*Parsimony GFI* ***(PGFI)***	0.617	>0.60	Good fit
	Parsimony CFI ***(PCFI)***	0.756	>0.60	Good fit
	Parsimony NFI ***(PNFI)***	0.681	>0.60	Good fit
		Solution is admissible	-	Acceptable fit

Regards to the ***hypotheses testing,*** in the scenario under analysis there are only seven hypotheses from 16 hypotheses depicted from the emerging theory, which we intend to test. According to the results depicted in **Table 5.27**, the hypotheses $\boldsymbol{H_5}$, $\boldsymbol{H_6}$ and $\boldsymbol{H_8}$ cannot be confirmed in the **Governance experience Scenario (φ_1)** due to they have no enough statistical significance. On the other hand, the remaining hypotheses in this scenario were confirmed: $\boldsymbol{H_2}$, $\boldsymbol{H_4}$, $\boldsymbol{H_{10}}$, and $\boldsymbol{H_{11}}$.

Table VII.47 – Hypothesis test for Governance experience Scenario (φ_1), ($\boldsymbol{n = 118}$). **Source:** Own elaboration from AMOS.

Hypotheses		Governance experience Scenario (φ_1)	Test	Comments
H_1	Agile governance $[G \leftarrow A]$	N/A	N/A	N/A
H_2	Agile governance $[B \leftarrow G]$	Significant ($\beta = 0.720$, ***)	Confirmed	N/A
H_3	Specific agility $[B \leftarrow A]$	N/A	N/A	N/A
H_4	Value delivery $[R \leftarrow B]$	Significant ($\beta = 0.702$, ***)	Confirmed	N/A
H_5	Moderator factors effects $[B \leftarrow M]$	Non-significant ($\beta = -0.071$, $p = 0.461$)	Not confirmed	Despite we can identify the negative influence from [M] upon [B] in current scenario, the hypothesis was not enough statistical significant.

Hypotheses		Governance experience Scenario (φ_1)	Test	Comments
H_6	Environmental factors effects [$B \leftarrow E$]	Non-significant ($\beta = 0.232$, $p = 0.058$)	Not confirmed	The hypothesis has no statistical significance, and the influence identified from [E] upon [B] by the study is not negative, as would be originally expected. In fact, when we realize that not only threats (negative influence) from Environmental factors effects [E] can jeopardize Business operations [B], but also opportunities (positive influence) can potentiate it. This evidence is supported by the emerging theory.
H_7	Moderator factors effects [$A \leftarrow M$]	N/A	N/A	N/A
H_8	Moderator factors effects [$G \leftarrow M$]	Non-significant ($\beta = 0.050$, $p = 0.682$)	Not confirmed	Despite we expect a negative influence, in current scenario we have indentify a very slight and positive influence from [M] upon [G], which was not enough statistical significant to confirm the current hypothesis.
H_9	Environmental Factors effects [$A \leftarrow E$]	N/A	N/A	N/A
H_{10}	Environmental factors effects [$G \leftarrow E$]	Significant ($\beta = 0.403$, $p = 0.003$ **)	Confirmed	N/A
H_{11}	Environmental factors effects [$M \leftarrow E$]	Significant ($\beta = 0.438$, ***)	Confirmed	N/A
H_{12}	Sustainability [$M \leftarrow A$]	N/A	N/A	N/A
H_{13}	Competitiveness [$E \leftarrow A$]	N/A	N/A	N/A
H_{14}	Sustainability [$M \leftarrow G$]	N/A	N/A	N/A
H_{15}	Competitiveness [$E \leftarrow G$]	N/A	N/A	N/A
H_{16}	Agile Governance mediation $\begin{bmatrix} A & & \\ \downarrow & \searrow & \\ G & \rightarrow & B \end{bmatrix}$	N/A	N/A	N/A
	Statistics	**Passed**: 4/7 **Refuted**:3/7	-	-
	Analysis	57% success	-	-

VII.4.3. Agile or Lean culture Scenario (φ_2)

From the model based on **Agile or Lean culture** or simply **Agile experience Scenario (φ_2)**, adjusted after EFA, and depicted in **Figure VII.14.(A)**, we have performed the estimation of the complete model (measurement sub-model + structural sub-model) with the aid of *IBM SPSS Amos 20.0* software, using the bootstrap procedure with 2000 resampling. The results of the estimation for the complete model are depicted in **Figure VII.14.(B)**.

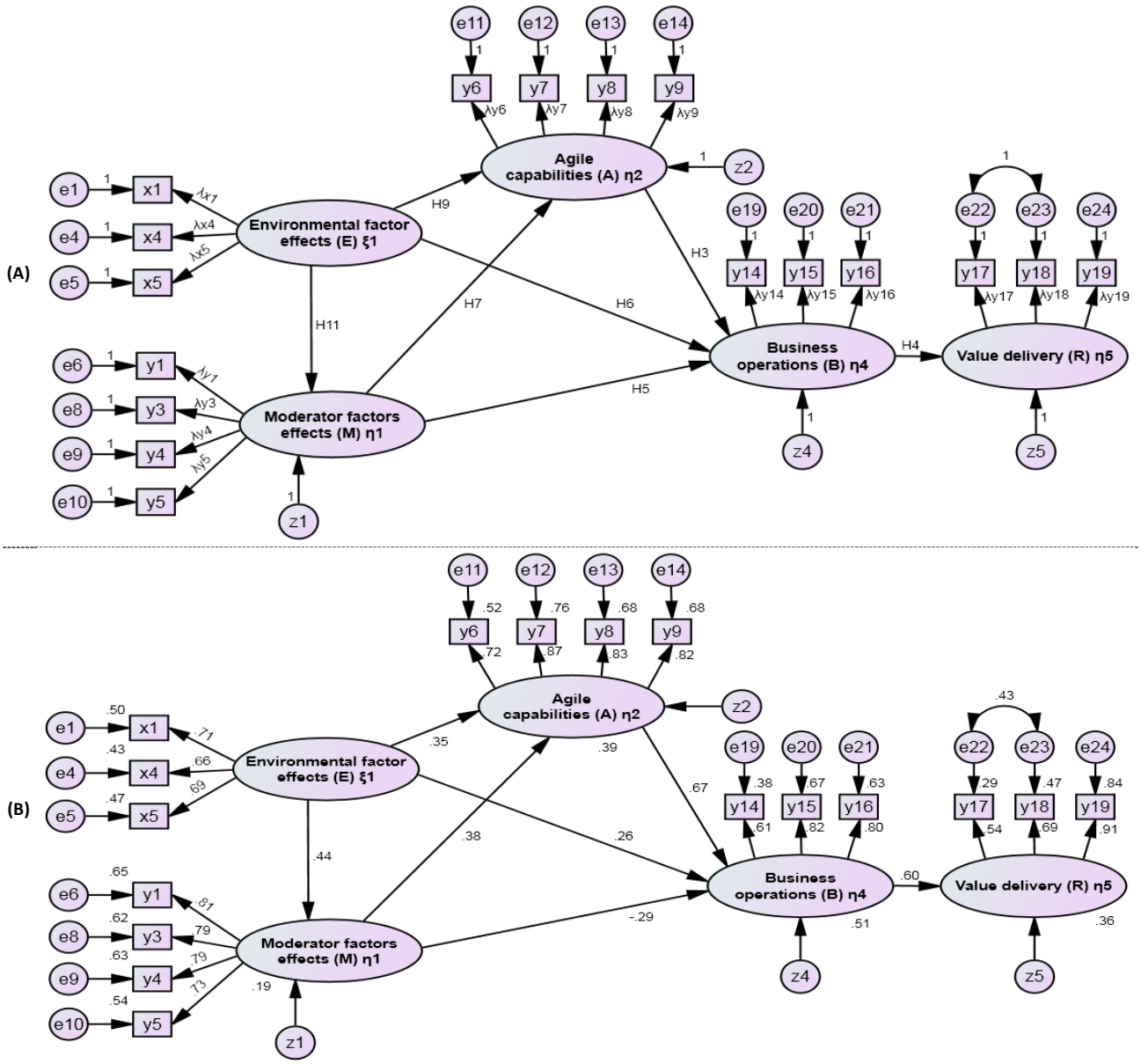


Figure VII.14 – (A) Theoretical model of structural equations based on *Agile experience Scenario* (φ_2). **(B)** Estimated model of structural equations with standardized weights for (φ_2), ($n = 118$). **Source**: Own elaboration.

The ***discriminant validity*** from the constructs for Agile experience Scenario (φ_2) is depicted in **Table 5.26**. In fact, the results have confirmed the *discriminant validity* for each construct that is present in the current theoretical scenario.

Table VII.48 – Discriminant validity from the constructs for Agile experience Scenario (φ_2), ($\boldsymbol{n = 118}$). **Source:** Own elaboration.

$i \leftarrow j$	Φ_{ij}	Φ_{ij}^2	AVE_i	AVE_j	$AVE_i \wedge AVE_j \geq \Phi_{ij}^2$?
M ← E	0.439	0.193	0.870	0.781	OK
A ← M	0.383	0.147	0.882	0.870	OK
A ← E	0.351	0.123	0.882	0.781	OK
B ← A	0.675	0.456	0.786	0.882	OK
B ← E	0.261	0.068	0.786	0.781	OK
B ← M	-0.288	0.083	0.786	0.870	OK
R ← B	0.603	0.364	0.714	0.786	OK

On the other hand, from the table values of *Squared Multiple Correlations* calculated by IBM® SPSS® Amos, was elaborated a summary depicted in **Table 5.27** for all endogenous latent variables of the model.

Table VII.49 – Variance explained by endogenous latent constructs for Agile experience Scenario (φ_2), ($\boldsymbol{n = 118}$). Source: Own elaboration from AMOS.

Endogenous latent variables	% of explained variance by the model
Effects of moderator factors [M]	19.3
Agile capabilities [A]	38.8
Business operations [B]	51.4
Value delivery [R]	36.4

We have found that only 51.4% of the variation of Business operations [B] and 36.4% of the variance of Value delivery [R] can be explained by the model proposed for Agile experience Scenario (φ_2). It is a intermediate explanatory power, for more than half of business operations [B], as well as for less than half of value delivery [R], can be measured by changes in the constructs included in the modeling, the remaining variance (48.6% and 83.6%, respectively for [B] and [R]) is attributed to factors not considered in the model depicted for this scenario. In this scenario the absence of the Governance capabilities [G], decrease significantly the explanatory power of the model related to this macro-system state regards to the agile governance phenomena.

Table VII.50 – Quality adjustment indices from model based on Agile experience Scenario (φ_2), ($\boldsymbol{n = 118}$). **Source:** Own elaboration from AMOS.

Group Analysis	Indices	Obtained values	Reference values for Analysis	Analysis
Fit tests	*Chi-square* ***(χ^2)***	112.520	lower is better	-
	Degrees of freedom ***(df)***	112	≥1	OK
	p-value	0.468	>0.05	OK
Absolute Indices	*Standardized Chi-square* ***(χ^2/df)***	1.005	<3	OK
	Root Mean Square Error of Approximation ***(RMSEA)***	0.006	<0.10	Good fit
	Goodness of Fit Index ***(GFI)***	0.901	>0.90	Good fit
Relative Indices	*Comparative Fit Index* ***(CFI)***	0.999	>0.90	Very good fit
	Normed Fit Index ***(NFI)***	0.890	>0.90	Acceptable fit
	Tucker-Lewis Index ***(TLI)***	0.999	>0.90	Very good fit
Parcimony Indices	*Parsimony GFI* ***(PGFI)***	0.659	>0.60	Good fit
	Parsimony CFI ***(PCFI)***	0.823	>0.60	Good fit
	Parsimony NFI ***(PNFI)***	0.733	>0.60	Good fit
		Solution is admissible	-	Acceptable fit

We have used the same adjustment strategy adopted in previous scenarios, correlating the errors from the manifest variables $\boldsymbol{y_{17}}$ and $\boldsymbol{y_{18}}$ in order to improve the goodness fit indices of the SEM model. After that, the SEM model which describes the current scenario has assumed

acceptable fit indices (although almost perfect CFI and TLI indices values), and can be described in terms of *overall acceptable quality adjustment indices*, as already discussed in Section 5.2.5.2.1. The ***quality adjustment indices*** for the current scenario are depicted in **Table VII**.50, as well as the test for each hypothesis depicted in this scenario is available at **Table VII**.51.

Regards to the ***hypotheses testing,*** in the scenario under analysis there are only seven hypotheses from 16 hypotheses depicted from the emerging theory, which we intend to test. According to the results depicted in **Table 5.27**, only the hypothesis $\boldsymbol{H_6}$ cannot be confirmed in the **Agile experience Scenario (φ_2)** due to it has no enough statistical significance. On the other hand, the remaining hypotheses in this scenario were confirmed: $\boldsymbol{H_3}$, $\boldsymbol{H_4}$, $\boldsymbol{H_5}$, $\boldsymbol{H_7}$, $\boldsymbol{H_9}$, and $\boldsymbol{H_{11}}$.

Table VII.51 – Hypothesis test for Agile experience Scenario (φ_2), ($\boldsymbol{n = 118}$). **Source:** Own elaboration from AMOS.

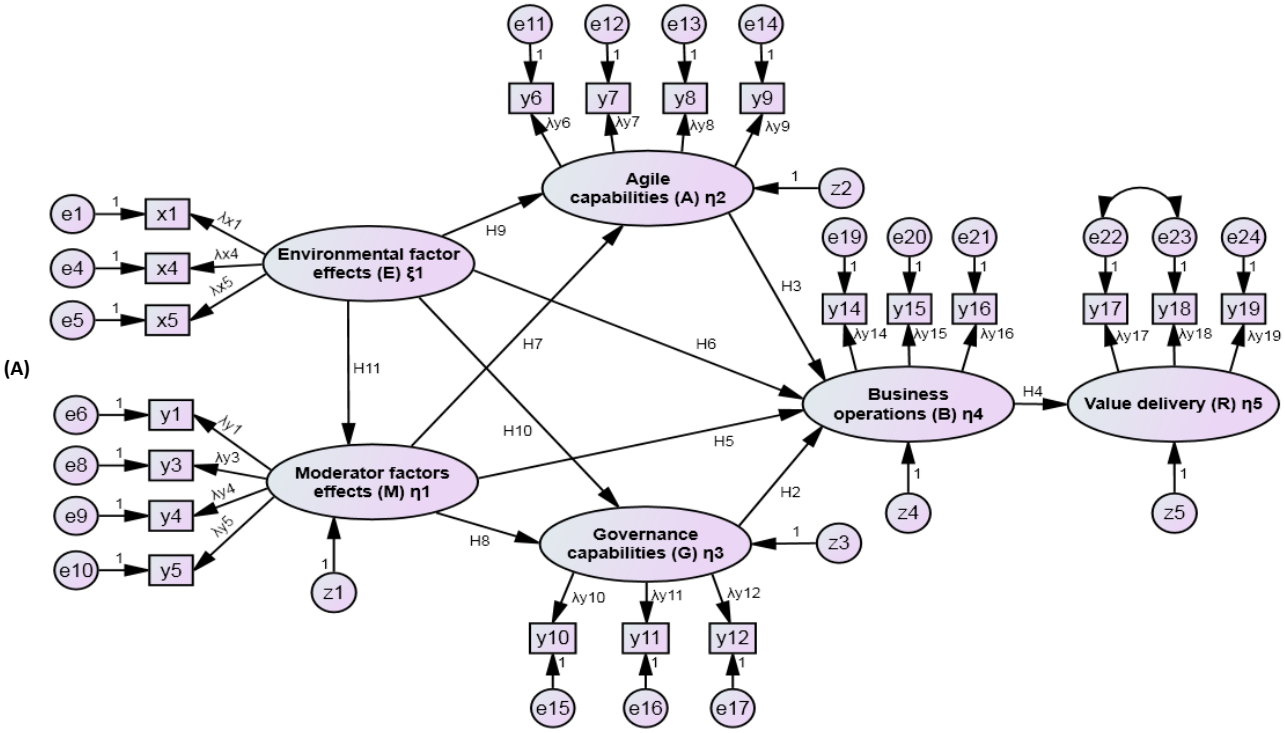
Hypotheses		Agile experience Scenario (φ_2)	Test	Comments
H_1	Agile governance $[G \leftarrow A]$	N/A	N/A	N/A
H_2	Agile governance $[B \leftarrow G]$	N/A	N/A	N/A
H_3	Specific agility $[B \leftarrow A]$	Significant ($\beta = 0.675$, ***)	Confirmed	N/A
H_4	Value delivery $[R \leftarrow B]$	Significant ($\beta = 0.603$, ***)	Confirmed	N/A
H_5	Moderator factors effects $[B \leftarrow M]$	Significant ($\beta = -0.288$, $p = 0.018$ **)	Confirmed	We have identified the negative influence from [M] upon [B] in current scenario, and the hypothesis has enough statistical significance.
H_6	Environmental factors effects $[B \leftarrow E]$	Non-significant ($\beta = 0.261$, $p = 0.052$)	Not confirmed	The hypothesis has no statistical significance, and the influence identified from [E] upon [B] by the study is not negative, as would be originally expected. In fact, when we realize that not only threats (negative influence) from Environmental factors effects [E] can jeopardize Business operations [B], but also opportunities (positive influence) can potentiate it. This evidence is supported by the emerging theory.
H_7	Moderator factors effects $[A \leftarrow M]$	Significant ($\beta = 0.383$, ***)	Confirmed	N/A
H_8	Moderator factors effects $[G \leftarrow M]$	N/A	N/A	N/A
H_9	Environmental Factors effects $[A \leftarrow E]$	Significant ($\beta = 0.351$, ***)	Confirmed	N/A
H_{10}	Environmental factors effects $[G \leftarrow E]$	N/A	N/A	N/A
H_{11}	Environmental factors effects $[M \leftarrow E]$	Significant ($\beta = 0.439$, ***)	Confirmed	N/A
H_{12}	Sustainability $[M \leftarrow A]$	N/A	N/A	N/A

Hypotheses		Agile experience Scenario (φ_2)	Test	Comments
H_{13}	Competitiveness $[E \leftarrow A]$	N/A	N/A	N/A
H_{14}	Sustainability $[M \leftarrow G]$	N/A	N/A	N/A
H_{15}	Competitiveness $[E \leftarrow G]$	N/A	N/A	N/A
H_{16}	Agile Governance mediation $\begin{bmatrix} A & & \\ \downarrow & \searrow & \\ G & \rightarrow & B \end{bmatrix}$	N/A	N/A	N/A
Statistics		**Passed**: 6/7 **Refuted**:1/7	-	-
Analysis		86% success	-	-

VII.4.4. Dissociative Scenario (φ_3)

From the model based on **Dissociative Scenario (φ_3)**, adjusted after EFA, and depicted in **Figure VII.15.(A)**, we have performed the estimation of the complete model (measurement sub-model + structural sub-model) with the aid of *IBM SPSS Amos 20.0* software, using the bootstrap procedure with 2000 resampling. The results of the estimation for the complete model are depicted in **Figure VII.15.(B)**.

(A)



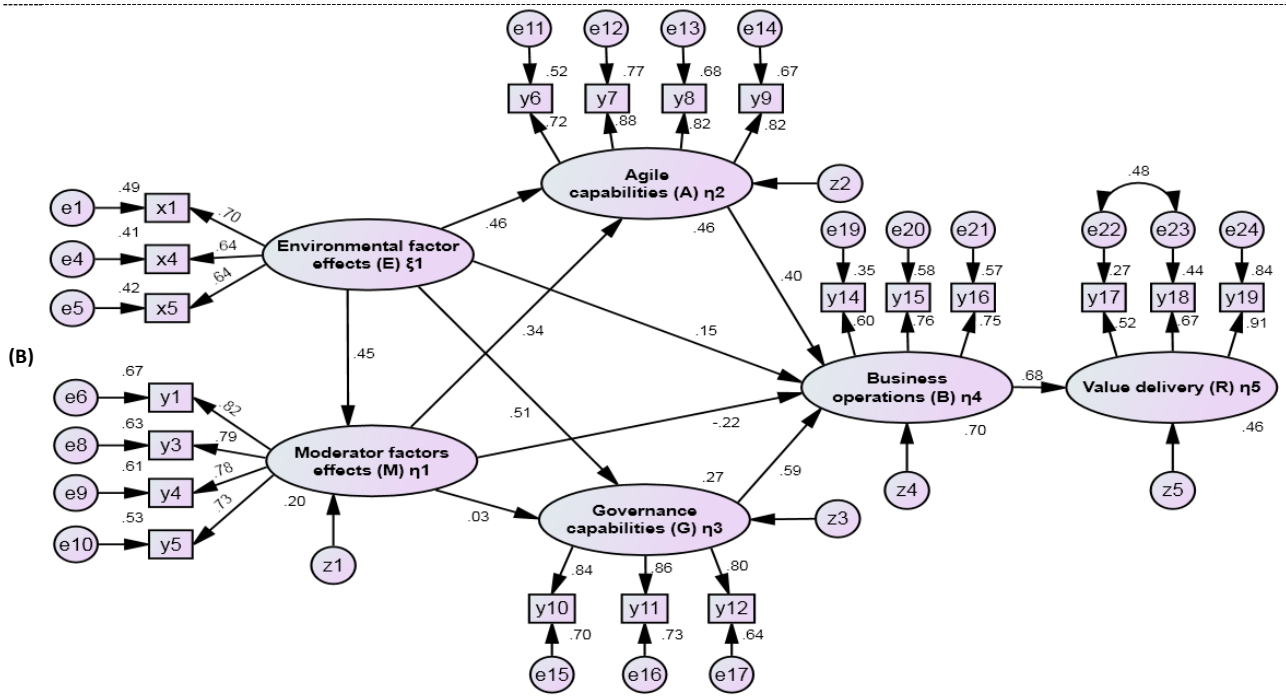


Figure VII.15 – (A) Theoretical model of structural equations based on *Dissociative Scenario* (φ_3). **(B)** Estimated model of structural equations with standardized weights for (φ_3), ($n = 118$). **Source**: Own elaboration.

The ***discriminant validity*** from the constructs for Dissociative Scenario (φ_3) is depicted in **Table VII**.52. In fact, the results have confirmed the *discriminant validity* for each construct that is present in the current theoretical scenario.

Table VII.52 – Discriminant validity from the constructs for Dissociative Scenario (φ_3), ($\boldsymbol{n = 118}$). **Source:** Own elaboration.

$i \leftarrow j$	Φ_{ij}	Φ_{ij}^2	AVE_i	AVE_j	$AVE_i \wedge AVE_j \geq \Phi_{ij}^2$?
M ← E	0.447	0.200	0.870	0.781	OK
A ← M	0.336	0.113	0.882	0.870	OK
A ← E	0.457	0.209	0.882	0.781	OK
G ← M	0.030	0.001	0.916	0.870	OK
G ← E	0.509	0.259	0.916	0.781	OK
B ← A	0.399	0.159	0.786	0.882	OK
B ← G	0.589	0.347	0.786	0.916	OK
B ← E	0.150	0.023	0.786	0.781	OK
B ← M	-0.222	0.049	0.786	0.870	OK
R ← B	0.677	0.458	0.714	0.786	OK

On the other hand, from the table values of *Squared Multiple Correlations* calculated by IBM® SPSS® Amos, was elaborated a summary depicted in **Table VII**.53 for all endogenous latent variables of the model.

We have found that only 70.4% of the variation of Business operations [B] and 45.8% of the variance of Value delivery [R] can be explained by the model proposed for Dissociative Scenario (φ_3). It is a high explanatory power, for more than half of business operations [B], as well as for

almost half of value delivery [R], can be measured by changes in the constructs included in the modeling, the remaining variance (29.6% and 44.2%, respectively for [B] and [R]) is attributed to factors not considered in the model depicted for this scenario.

Table VII.53 – Variance explained by endogenous latent constructs for Dissociative Scenario (φ_3), ($\boldsymbol{n = 118}$). **Source:** Own elaboration from AMOS.

Endogenous latent variables	% of explained variance by the model
Effects of moderator factors [M]	20.0
Agile capabilities [A]	45.8
Governance capabilities [G]	27.4
Business operations [B]	70.4
Value delivery [R]	45.8

We have used the same adjustment strategy adopted in previous scenarios, correlating the errors from the manifest variables $\boldsymbol{y_{17}}$ and $\boldsymbol{y_{18}}$ in order to improve the goodness fit indices of the SEM model. After that, the SEM model which describes the current scenario has assumed *acceptable fit indices*, and can be described in terms of *overall acceptable quality adjustment indices*, as already discussed in Section 5.2.5.2.1. The ***quality adjustment indices*** for the current scenario are depicted in **Table VII**.54, as well as the test for each hypothesis depicted in this scenario is available at **Table VII**.55.

Table VII.54 – Quality adjustment indices from model based on Dissociative Scenario (φ_3), ($\boldsymbol{n = 118}$). **Source:** Own elaboration from AMOS.

Group Analysis	Indices	Obtained values	Reference values for Analysis	Analysis
Fit tests	*Chi-square* ***(χ^2)***	223.829	lower is better	-
	Degrees of freedom ***(df)***	159	≥1	OK
	p-value	0.001	>0.05	Acceptable fit
Absolute Indices	*Standardized Chi-square* ***(χ^2/df)***	1.408	<3	OK
	Root Mean Square Error of Approximation ***(RMSEA)***	0.059	<0.10	Good fit
	Goodness of Fit Index ***(GFI)***	0.844	>0.90	Acceptable fit
Relative Indices	*Comparative Fit Index* ***(CFI)***	0.945	>0.90	Good fit
	Normed Fit Index ***(NFI)***	0.835	>0.90	Acceptable fit
	Tucker-Lewis Index ***(TLI)***	0.934	>0.90	Good fit
Parcimony Indices	*Parsimony GFI* ***(PGFI)***	0.639	>0.60	Good fit
	Parsimony CFI ***(PCFI)***	0.790	>0.60	Good fit
	Parsimony NFI ***(PNFI)***	0.699	>0.60	Good fit
		Solution is admissible	-	Acceptable fit

Regards to the ***hypotheses testing***, in the scenario under analysis there are only ten hypotheses from 16 hypotheses depicted from the emerging theory, which we intend to test. According to the results depicted in **Table VII**.55, only the hypotheses $\boldsymbol{H_6}$ and $\boldsymbol{H_8}$ could not be confirmed in the **Dissociative Scenario (φ_3)** due to they have no enough statistical significance. On the other

hand, the remaining hypotheses in this scenario were confirmed: $\boldsymbol{H_2}$, $\boldsymbol{H_3}$, $\boldsymbol{H_4}$, $\boldsymbol{H_5}$, $\boldsymbol{H_7}$, $\boldsymbol{H_9}$, $\boldsymbol{H_{10}}$, and $\boldsymbol{H_{11}}$.

Table VII.55 – Hypothesis test for Dissociative Scenario (φ_3), ($\boldsymbol{n = 118}$). **Source:** Own elaboration from AMOS.

Hypotheses		Dissociative Scenario (φ_3)	Test	Comments
H_1	Agile governance $[G \leftarrow A]$	N/A	N/A	N/A
H_2	Governance $[B \leftarrow G]$	Significant ($\beta = 0.589$, ***)	Confirmed	N/A
H_3	Specific agility $[B \leftarrow A]$	Significant ($\beta = 0.399$, $p = 0.004$ **)	Confirmed	N/A
H_4	Value delivery $[R \leftarrow B]$	Significant ($\beta = 0.677$, ***)	Confirmed	N/A
H_5	Moderator factors effects $[B \leftarrow M]$	Significant ($\beta = -0.222$, $p = 0.041$ *)	Confirmed	We have identified the negative influence from [M] upon [B] in current scenario, and the hypothesis has enough statistical significance.
H_6	Environmental factors effects $[B \leftarrow E]$	Non-significant ($\beta = 0.150$, $p = 0.275$)	Not confirmed	The hypothesis has no statistical significance, and the influence identified from [E] upon [B] by the study was not negative, as would be originally expected. In fact, when we realize that not only threats (negative influence) from Environmental factors effects [E] can jeopardize Business operations [B], but also opportunities (positive influence) can potentiate it. This evidence is supported by the emerging theory.
H_7	Moderator factors effects $[A \leftarrow M]$	Significant ($\beta = 0.336$, $p = 0.003$ **)	Confirmed	N/A
H_8	Moderator factors effects $[G \leftarrow M]$	Non-significant ($\beta = 0.030$, $p = 0.814$)	Not confirmed	We could not identify the negative influence from [M] upon [G] in current scenario, and the hypothesis has no enough statistical significance.
H_9	Environmental Factors effects $[A \leftarrow E]$	Significant ($\beta = 0.457$, $p = 0.001$ ***)	Confirmed	N/A
H_{10}	Environmental factors effects $[G \leftarrow E]$	Significant ($\beta = 0.509$, $p = 0.001$ ***)	Confirmed	N/A
H_{11}	Environmental factors effects $[M \leftarrow E]$	Significant ($\beta = 0.447$, ***)	Confirmed	N/A
H_{12}	Sustainability $[M \leftarrow A]$	N/A	N/A	N/A
H_{13}	Competitiveness $[E \leftarrow A]$	N/A	N/A	N/A
H_{14}	Sustainability $[M \leftarrow G]$	N/A	N/A	N/A
H_{15}	Competitiveness $[E \leftarrow G]$	N/A	N/A	N/A
H_{16}	Agile Governance mediation $\begin{bmatrix} A & & \\ \downarrow & \searrow & \\ G & \rightarrow & B \end{bmatrix}$	N/A	N/A	N/A
	Statistics	**Passed**: 8/10 **Refuted**:2/10	-	-
	Analysis	80% success	-	-

VII.4.5. Sustainability Scenario (φ_5')

From the model based on **Sustainability Scenario (φ_5')**, adjusted after EFA, and depicted in **Figure VII.16.(A)**, we have performed the estimation of the complete model (measurement sub-model + structural sub-model) with the aid of *IBM SPSS Amos 20.0* software, using the bootstrap procedure with 2000 resampling. The results of the estimation for the complete model are depicted in **Figure VII.16.(B)**.

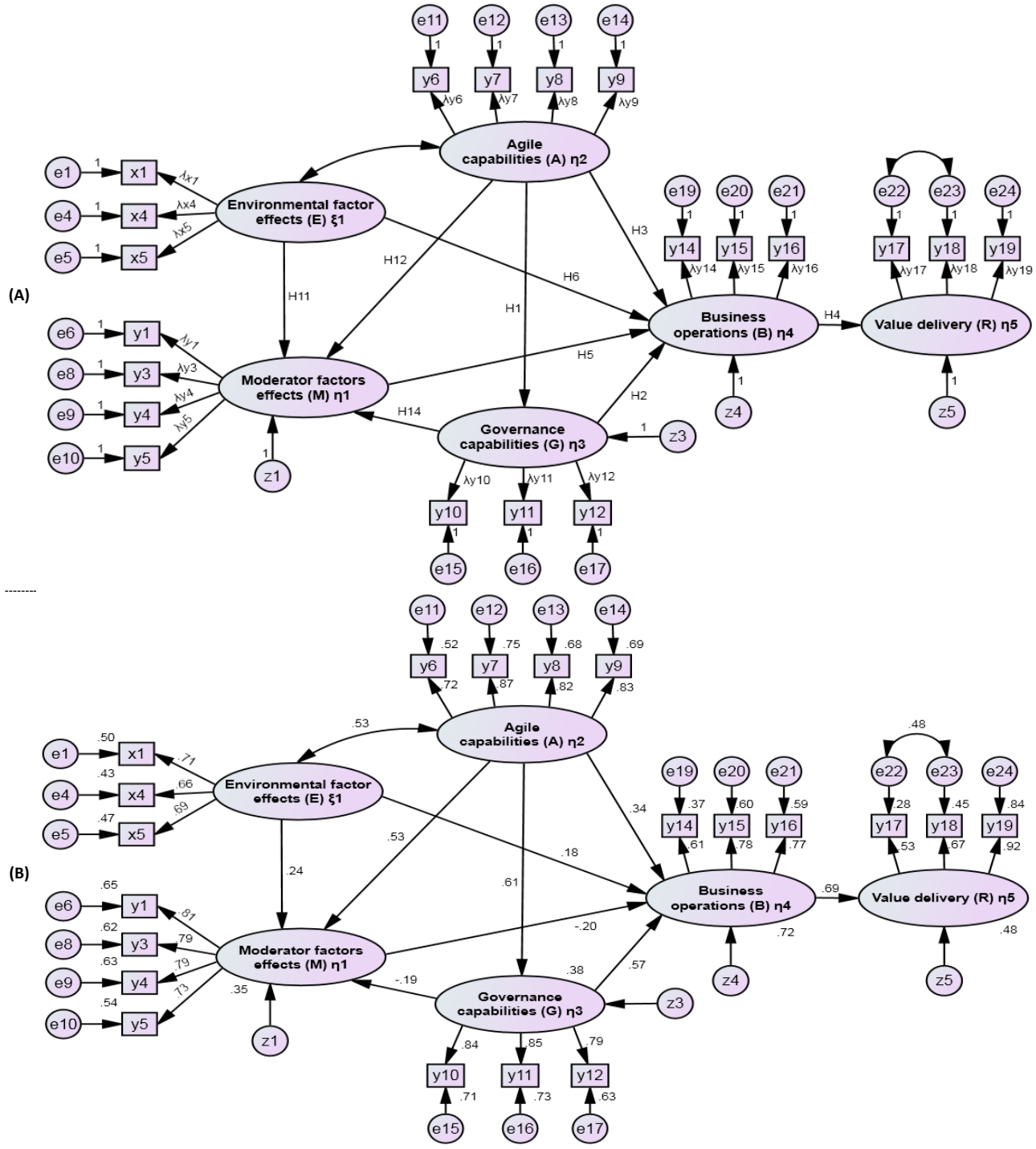


Figure VII.16 – **(A)** Theoretical model of structural equations based on *Sustainability Scenario* (φ_5'). **(B)** Estimated model of structural equations with standardized weights for (φ_5'), ($n = 118$). **Source**: Own elaboration.

The ***discriminant validity*** from the constructs for Sustainability Scenario (φ_5') is depicted in **Table VII**.56. In fact, the results have confirmed the *discriminant validity* for each construct that is present in the current theoretical scenario.

Table VII.56 – Discriminant validity from the constructs for *Sustainability Scenario* (φ_5'), ($\boldsymbol{n = 118}$). **Source:** Own elaboration.

i	←	j	Φ_{ij}	Φ_{ij}^2	AVE_i	AVE_j	$AVE_i \wedge AVE_j \geq \Phi_{ij}^2$?
G	←	A	0.613	0.376	0.916	0.882	OK
M	←	E	0.235	0.055	0.870	0.781	OK
M	←	A	0.531	0.282	0.870	0.882	OK
M	←	G	-0.191	0.036	0.870	0.916	OK
B	←	A	0.338	0.114	0.786	0.882	OK
B	←	G	0.568	0.323	0.786	0.916	OK
B	←	E	0.181	0.033	0.786	0.781	OK
B	←	M	-0.198	0.039	0.786	0.870	OK
R	←	B	0.692	0.479	0.714	0.786	OK

On the other hand, from the table values of *Squared Multiple Correlations* calculated by IBM® SPSS® Amos, was elaborated a summary depicted in **Table VII**.57 for all endogenous latent variables of the model.

Table VII.57 – Variance explained by endogenous latent constructs for *Sustainability Scenario* (φ_5'), ($\boldsymbol{n = 118}$). **Source:** Own elaboration from AMOS.

Endogenous latent variables	% of explained variance by the model
Effects of moderator factors [M]	35.2
Governance capabilities [G]	37.6
Business operations [B]	72.4
Value delivery [R]	47.9

We have found that only 72.4% of the variation of Business operations [B] and 47.9% of the variance of Value delivery [R] can be explained by the model proposed for Sustainability Scenario (φ_5'). It is a high explanatory power, for more than half of business operations [B], as well as for almost half of value delivery [R], can be measured by changes in the constructs included in the modeling, the remaining variance (27.6% and 52.1%, respectively for [B] and [R]) is attributed to factors not considered in the model depicted for this scenario.

In this theoretical scenario *Agile capabilities [A]* behave as an independent variable, due to [A] is not under the directional and sequential influence of *Environmental factors effects [E]* described by the **Law 4**. Because of this, we had to correlate [A] with [E] in order to proceed the model estimation. We also have used the same adjustment strategy adopted in previous scenarios, correlating the errors from the manifest variables $\boldsymbol{y_{17}}$ and $\boldsymbol{y_{18}}$ in order to improve the goodness fit indices of the SEM model. After that, the SEM model which describes the

current scenario has assumed *acceptable fit indices*, and can be described in terms of *overall acceptable quality adjustment indices*, as already discussed in Section 5.2.5.2.1. The ***quality adjustment indices*** for the current scenario are depicted in **Table VII**.58, as well as the test for each hypothesis depicted in this scenario is available at **Table VII**.59.

Table VII.58 – Quality adjustment indices from model based on *Sustainability Scenario* (φ_5'), ($\boldsymbol{n = 118}$). **Source:** Own elaboration from AMOS.

Group Analysis	Indices	Obtained values	Reference values for Analysis	Analysis
Fit tests	*Chi-square* ***(χ^2)***	203.838	lower is better	-
	Degrees of freedom ***(df)***	159	≥1	OK
	p-value	0.009	>0.05	Acceptable fit
Absolute Indices	*Standardized Chi-square* ***(χ^2/df)***	1.282	<3	OK
	Root Mean Square Error of Approximation ***(RMSEA)***	0.049	<0.10	Good fit
	Goodness of Fit Index ***(GFI)***	0.856	>0.90	Acceptable fit
Relative Indices	*Comparative Fit Index* ***(CFI)***	0.962	>0.90	Good fit
	Normed Fit Index ***(NFI)***	0.850	>0.90	Acceptable fit
	Tucker-Lewis Index ***(TLI)***	0.954	>0.90	Good fit
Parcimony Indices	*Parsimony GFI* ***(PGFI)***	0.648	>0.60	Good fit
	Parsimony CFI ***(PCFI)***	0.805	>0.60	Good fit
	Parsimony NFI ***(PNFI)***	0.711	>0.60	Good fit
		Solution is admissible	-	Acceptable fit

Regards to the ***hypotheses testing***, in the scenario under analysis there are only ten hypotheses from 16 hypotheses depicted from the emerging theory, which we intend to test. According to the results depicted in **Table VII**.59, only the hypotheses $\boldsymbol{H_5}$, $\boldsymbol{H_6}$, $\boldsymbol{H_{11}}$, and $\boldsymbol{H_{14}}$ could not be confirmed in the **Sustainability Scenario (φ_5')** due to they have no enough statistical significance. On the other hand, the remaining hypotheses in this scenario were confirmed: $\boldsymbol{H_1}$, $\boldsymbol{H_2}$, $\boldsymbol{H_3}$, $\boldsymbol{H_4}$, $\boldsymbol{H_{12}}$ and $\boldsymbol{H_{16}}$.

Table VII.59 – Hypothesis test for *Sustainability Scenario* (φ_5'), ($\boldsymbol{n = 118}$). **Source:** Own elaboration from AMOS.

Hypotheses		Sustainability Scenario (φ_5')	Test	Comments
H_1	Agile governance $[G \leftarrow A]$	Significant ($\beta = 0.613$, ***)	Confirmed	N/A
H_2	Agile governance $[B \leftarrow G]$	Significant ($\beta = 0.568$, ***)	Confirmed	N/A
H_3	Specific agility $[B \leftarrow A]$	Significant ($\beta = 0.338$, $p = 0.016$ *)	Confirmed	N/A
H_4	Value delivery $[R \leftarrow B]$	Significant ($\beta = 0.692$, ***)	Confirmed	N/A
H_5	Moderator factors effects $[B \leftarrow M]$	Non-significant ($\beta = -0.198$, $p = 0.066$)	Not confirmed	We have identified the negative influence from [M] upon [B] in current scenario, but the hypothesis has no enough statistical significance.

Hypotheses		Sustainability Scenario (φ_5')	Test	Comments
H_6	Environmental factors effects [$B \leftarrow E$]	Non-significant ($\beta = 0.181$, $p = 0.119$)	Not confirmed	The hypothesis has no statistical significance, and the influence identified from [E] upon [B] by the study was not negative, as would be originally expected. In fact, when we realize that not only threats (negative influence) from Environmental factors effects [E] can jeopardize Business operations [B], but also opportunities (positive influence) can potentiate it. This evidence is supported by the emerging theory.
H_7	Moderator factors effects [$A \leftarrow M$]	N/A	N/A	N/A
H_8	Moderator factors effects [$G \leftarrow M$]	N/A	N/A	N/A
H_9	Environmental Factors effects [$A \leftarrow E$]	N/A	N/A	N/A
H_{10}	Environmental factors effects [$G \leftarrow E$]	N/A	N/A	N/A
H_{11}	Environmental factors effects [$M \leftarrow E$]	Non-significant ($\beta = 0.235$, $p = 0.070$)	Not confirmed	We have identified the positive influence from [M] upon [E] in current scenario, but the hypothesis has no enough statistical significance.
H_{12}	Sustainability [$M \leftarrow A$]	Significant ($\beta = 0.531$, ***)	Confirmed	N/A
H_{13}	Competitiveness [$E \leftarrow A$]	N/A	N/A	N/A
H_{14}	Sustainability [$M \leftarrow G$]	Non-significant ($\beta = -0.191$, $p = 0.136$)	Not confirmed	We could not identify the positive influence from [G] upon [M] in current scenario, and the hypothesis has no enough statistical significance. On the other hand, we can interpret the negative influence evidenced by this study as the expected nullification effect from [G] on [M], stated by the current hypothesis. This evidence is supported by the emerging theory.
H_{15}	Competitiveness [$E \leftarrow G$]	N/A	N/A	N/A

Hypotheses		Sustainability Scenario (φ_5')	Test	Comments
H_{16}	Agile Governance mediation $\begin{bmatrix} A & & \\ \downarrow & \searrow & \\ G & \rightarrow & B \end{bmatrix}$	• **Sobel test:** ▪ For $\alpha = 0.05$, $\lvert Z \rvert = 3.339 > Z_{0.975} = 1.96$, $p = 0.001$ ***: significant • **Bootstrap test:** ▪ For $p_{A\rightarrow B} = 0.001$ ***, $p_{G\rightarrow B} = 0.001$ ** *: significant	Confirmed by both tests	The Governance capabilities [G] has an mediation effect of the Agile capabilities [A] upon the Business Operations [B]. In other words, the total effect caused by [A] on [B] can be separated into direct effect of trajectory [A→B] ($\beta_{A\rightarrow B} = 0.338$; $p < 0.016$ *), as well as the indirect effect of the trajectory described by [A→G] ($\beta_{A\rightarrow G} = 0.613$; $p < 0.001$***) and [G→B] ($\beta_{G\rightarrow B} = 0.568$; $p < 0.001$***). Cohen et al. (2003) suggest that when all trajectories between mediators are significant, then the global mediation effect is also significant. As pointed out by Little et al. (2007), a *partially mediated relationship* is indicated if the direct effect of the mediator construct,[G], accounts for a significant amount of variance in [B], while the direct effect of the predictor construct [A] remains significant. Based on those results, we can also imply that the effect of Agility [A] on Business Operations [B] has an greater intensity when applied by means of the mediation of Governance capabilities [G], than when is applied directly upon [B]. These findings are empirical evidences from the plausibility of: 1st Law, 2nd Law, and theory's premises.
	Statistics	**Passed**: 6/10 **Refuted**:4/10	-	-
	Analysis	60% success	-	-

VII.4.6. Competitiveness Scenario (φ_5'')

From the model based on **Competitiveness Scenario (φ_5'')**, adjusted after EFA, and depicted in **Figure VII.17.(A)**, we have performed the estimation of the complete model (measurement sub-model + structural sub-model) with the aid of *IBM SPSS Amos 20.0* software, using the bootstrap procedure with 2000 resampling. The results of the estimation for the complete model are depicted in **Figure VII.17.(B)**.

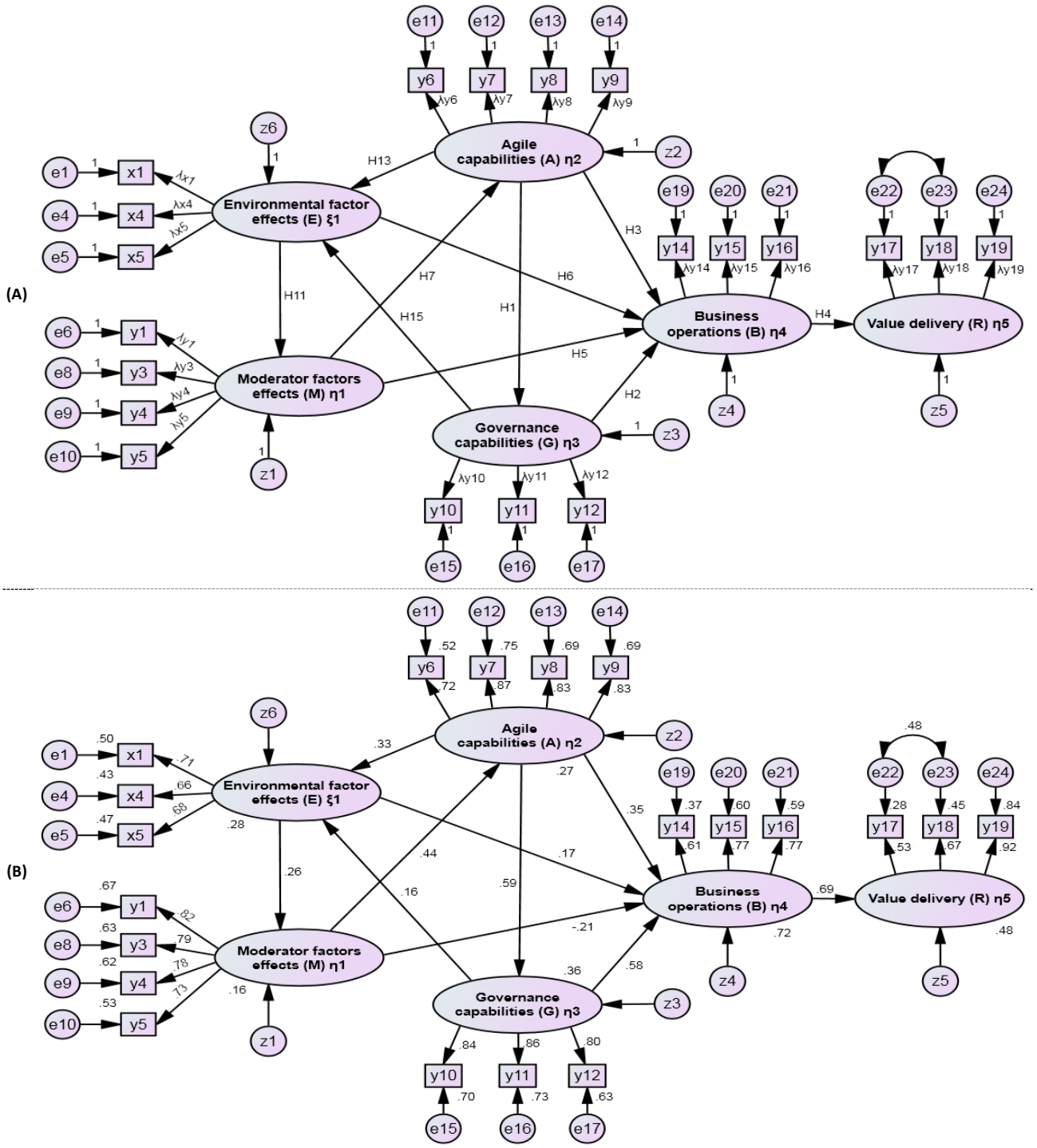


Figure VII.17 – **(A)** Theoretical model of structural equations based on *Competitiveness Scenario* (φ_5''). **(B)** Estimated model of structural equations with standardized weights for (φ_5''), ($n = 118$). **Source**: Own elaboration.

The ***discriminant validity*** from the constructs for Competitiveness Scenario (φ_5'') is depicted in **Table VII**.60. In fact, the results have confirmed the *discriminant validity* for each construct that is present in the current theoretical scenario.

Table VII.60 – Discriminant validity from the constructs for *Competitiveness Scenario* (φ_5''), ($\boldsymbol{n = 118}$). **Source:** Own elaboration.

$i \leftarrow j$	Φ_{ij}	Φ_{ij}^2	AVE_i	AVE_j	$AVE_i \wedge AVE_j \geq \Phi_{ij}^2$?
B ← A	0.350	0.123	0.786	0.882	OK
B ← G	0.576	0.332	0.786	0.916	OK

i ← j	Φ_{ij}	Φ_{ij}^2	AVE_i	AVE_j	$AVE_i \wedge AVE_j \geq \Phi_{ij}^2$?
B ← E	0.173	0.030	0.786	0.781	OK
B ← M	-0.212	0.045	0.786	0.870	OK
R ← B	0.690	0.476	0.714	0.786	OK
G ← A	0.587	0.345	0.916	0.882	OK
M ← E	0.263	0.069	0.870	0.781	OK
A ← M	0.443	0.196	0.882	0.870	OK
E ← G	0.164	0.027	0.781	0.916	OK
E ← A	0.332	0.110	0.781	0.882	OK

On the other hand, from the table values of *Squared Multiple Correlations* calculated by IBM® SPSS® Amos, was elaborated a summary depicted in **Table VII**.61 for all endogenous latent variables of the model. Observe that in this theoretical scenario there is no exogenous latent variables.

Table VII.61 – Variance explained by endogenous latent constructs for *Competitiveness Scenario* (φ_5''), ($\boldsymbol{n = 118}$)**. Source:** Own elaboration from AMOS.

Endogenous latent variables	% of explained variance by the model
Effects of environmental factors [E]	27.8
Effects of moderator factors [M]	15.8
Agile capabilities [A]	27.3
Governance capabilities [G]	36.0
Business operations [B]	72.3
Value delivery [R]	47.5

We have found that only 72.3% of the variation of Business operations [B] and 47.5% of the variance of Value delivery [R] can be explained by the model proposed for Competitiveness Scenario (φ_5''). It is a high explanatory power, for more than half of business operations [B], as well as for almost half of value delivery [R], can be measured by changes in the constructs included in the modeling, the remaining variance (27.7% and 52.5%, respectively for [B] and [R]) is attributed to factors not considered in the model depicted for this scenario.

We also have used the same adjustment strategy adopted in previous scenarios, correlating the errors from the manifest variables $\boldsymbol{y_{17}}$ and $\boldsymbol{y_{18}}$ in order to improve the goodness fit indices of the SEM model. After that, the SEM model which describes the current scenario has assumed *acceptable fit indices*, and can be described in terms of *overall acceptable quality adjustment indices*, as already discussed in Section 5.2.5.2.1. The ***quality adjustment indices*** for the current scenario are depicted in **Table VII**.62, as well as the test for each hypothesis depicted in this scenario is available at **Table VII**.63.

Table VII.62 – Quality adjustment indices from model based on *Competitiveness Scenario* (φ_5''), ($\boldsymbol{n = 118}$). **Source:** Own elaboration from AMOS.

Group Analysis	Indices	Obtained values	Reference values for Analysis	Analysis
Fit tests	*Chi-square* ***(χ^2)***	204.705	lower is better	-
	Degrees of freedom ***(df)***	159	≥1	OK
	p-value	0.008	>0.05	Acceptable fit
Absolute Indices	*Standardized Chi-square* ***(χ^2/df)***	1.287	<3	OK
	Root Mean Square Error of Approximation ***(RMSEA)***	0.050	<0.10	Good fit
	Goodness of Fit Index ***(GFI)***	0.856	>0.90	Acceptable fit
Relative Indices	*Comparative Fit Index* ***(CFI)***	0.961	>0.90	Good fit
	Normed Fit Index ***(NFI)***	0.850	>0.90	Acceptable fit
	Tucker-Lewis Index ***(TLI)***	0.953	>0.90	Good fit
Parcimony Indices	*Parsimony GFI* ***(PGFI)***	0.648	>0.60	Good fit
	Parsimony CFI ***(PCFI)***	0.804	>0.60	Good fit
	Parsimony NFI ***(PNFI)***	0.711	>0.60	Good fit
		Solution is admissible	-	Acceptable fit

Regards to the ***hypotheses testing***, in the scenario under analysis there are only ten hypotheses from 16 hypotheses depicted from the emerging theory, which we intend to test. According to the results depicted in **Table VII**.63, only the hypotheses $\boldsymbol{H_6}$, $\boldsymbol{H_{11}}$, and $\boldsymbol{H_{15}}$ could not be confirmed in the **Competitiveness Scenario (φ_5'')** due to they have no enough statistical significance. On the other hand, the remaining hypotheses in this scenario were confirmed: $\boldsymbol{H_1}$, $\boldsymbol{H_2}$, $\boldsymbol{H_3}$, $\boldsymbol{H_4}$, $\boldsymbol{H_5}$, $\boldsymbol{H_7}$, $\boldsymbol{H_{13}}$ and $\boldsymbol{H_{16}}$.

Table VII.63 – Hypothesis test for *Competitiveness Scenario* (φ_5''), ($\boldsymbol{n = 118}$). **Source:** Own elaboration from AMOS.

Hypotheses		Sustainability Scenario (φ_5')	Test	Comments
H_1	Agile governance [$G \leftarrow A$]	Significant ($\beta = 0.587$, ***)	Confirmed	N/A
H_2	Agile governance [$B \leftarrow G$]	Significant ($\beta = 0.576$, ***)	Confirmed	N/A
H_3	Specific agility [$B \leftarrow A$]	Significant ($\beta = 0.350$, $p = 0.009$ **)	Confirmed	N/A
H_4	Value delivery [$R \leftarrow B$]	Significant ($\beta = 0.690$, ***)	Confirmed	N/A
H_5	Moderator factors effects [$B \leftarrow M$]	Significant ($\beta = -0.212$ $p = 0.042$)	Confirmed	We have identified the negative influence from [M] upon [B] in current scenario, and the hypothesis has enough statistical significance.

Hypotheses		Sustainability Scenario (φ_5')	Test	Comments
H_6	Environmental factors effects [$B \leftarrow E$]	Non-significant ($\beta = 0.181$, $p = 0.138$)	Not confirmed	The hypothesis has no statistical significance, and the influence identified from [E] upon [B] by the study was not negative, as would be originally expected. In fact, when we realize that not only threats (negative influence) from Environmental factors effects [E] can jeopardize Business operations [B], but also opportunities (positive influence) can potentiate it. This evidence is supported by the emerging theory.
H_7	Moderator factors effects [$A \leftarrow M$]	Significant ($\beta = 0.443$, ***)	Confirmed	N/A
H_8	Moderator factors effects [$G \leftarrow M$]	N/A	N/A	N/A
H_9	Environmental Factors effects [$A \leftarrow E$]	N/A	N/A	N/A
H_{10}	Environmental factors effects [$G \leftarrow E$]	N/A	N/A	N/A
H_{11}	Environmental factors effects [$M \leftarrow E$]	Non-significant ($\beta = 0.263$, $p = 0.066$)	Not confirmed	We have identified the positive influence from [M] upon [E] in current scenario, but the hypothesis has no enough statistical significance.
H_{12}	Sustainability [$M \leftarrow A$]	N/A	N/A	N/A
H_{13}	Competitiveness [$E \leftarrow A$]	Significant ($\beta = 0.332$, $p = 0.033$ *)	Confirmed	N/A
H_{14}	Sustainability [$M \leftarrow G$]	N/A	N/A	N/A
H_{15}	Competitiveness [$E \leftarrow G$]	Non-significant ($\beta = 0.164$, $p = 0.252$)	Not confirmed	We have identified a little positive influence from [G] upon [E] in current scenario, but the hypothesis has no enough statistical significance.

Hypotheses		Sustainability Scenario (φ_5')	Test	Comments
H_{16}	Agile Governance mediation $\begin{bmatrix} A & & \\ \downarrow & \searrow & \\ G & \rightarrow & B \end{bmatrix}$	• **Sobel test:** ▪ For $\alpha = 0.05$, $\lvert Z\rvert = 3.325 > Z_{0.975} = 1.96$, $p = 0.001$ ***: significant • **Bootstrap test:** ▪ For $p_{A\rightarrow B} = 0.001$ ***, $p_{G\rightarrow B} = 0.001$ ** *: significant	Confirmed by both tests	The Governance capabilities [G] has an mediation effect of the Agile capabilities [A] upon the Business Operations [B]. In other words, the total effect caused by [A] on [B] can be separated into direct effect of trajectory [A→B] ($\beta_{A\rightarrow B} = 0.350$; $p < 0.009$ **), as well as the indirect effect of the trajectory described by [A→G] ($\beta_{A\rightarrow G} = 0.587$; $p < 0.001$***) and [G→B] ($\beta_{G\rightarrow B} = 0.576$; $p < 0.001$***). Cohen et al. (2003) suggest that when all trajectories between mediators are significant, then the global mediation effect is also significant. As pointed out by Little et al. (2007), a *partially mediated relationship* is indicated if the direct effect of the mediator construct,[G], accounts for a significant amount of variance in [B], while the direct effect of the predictor construct [A] remains significant. Based on those results, we can also imply that the effect of Agility [A] on Business Operations [B] has an greater intensity when applied by means of the mediation of Governance capabilities [G], than when applied directly upon [B]. These findings are empirical evidences from the plausibility of: 1st Law, 2nd Law, and theory's premises.
	Statistics	**Passed**: 8/11 **Refuted**:3/11	-	-
	Analysis	73% success	-	-

VII.4.7. Dynamic Scenario (φ_n)

From the model based on **Dynamic Scenario (φ_n)**, adjusted after EFA, and depicted in **Figure VII.18.(A)**, we have performed the estimation of the complete model (measurement sub-model + structural sub-model) with the aid of *IBM SPSS Amos 20.0* software, using the bootstrap procedure with 2000 resampling. The results of the estimation for the complete model are depicted in **Figure VII.18.(B)**.

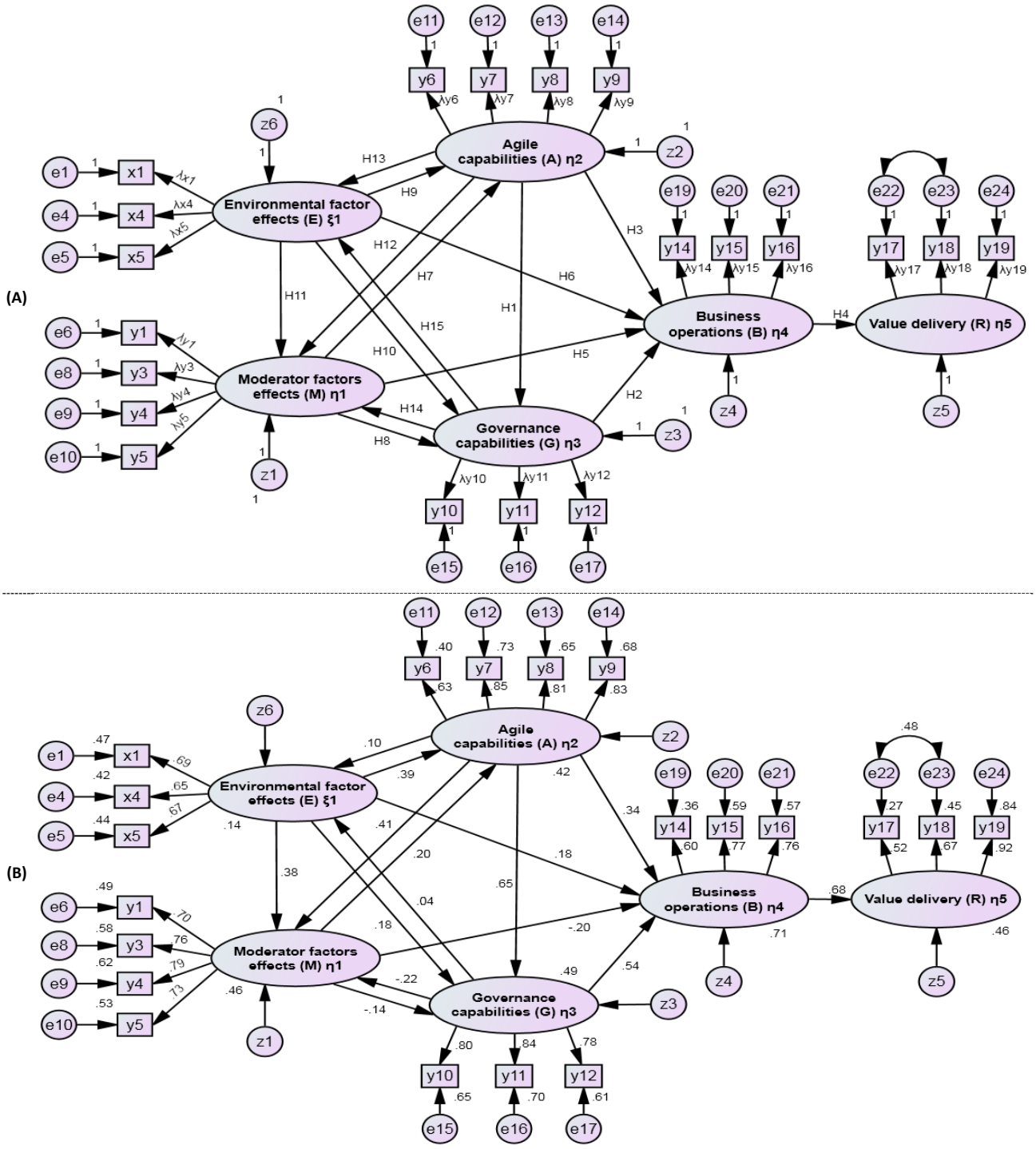


Figure VII.18 – (A) Theoretical model of structural equations based on *Dynamic Scenario* (φ_n). **(B)** Estimated model of structural equations with standardized weights for (φ_n), ($n = 118$). **Source**: Own elaboration.

The ***discriminant validity*** from the constructs for Dynamic Scenario (φ_n) is depicted in **Table VII**.64. In fact, the results have confirmed the *discriminant validity* for each construct that is present in the current theoretical scenario.

Table VII.64 – Discriminant validity from the constructs for *Dynamic Scenario* (φ_n), ($\boldsymbol{n = 118}$). **Source:** Own elaboration.

i ← j	Φ_{ij}	Φ_{ij}^2	AVE_i	AVE_j	$AVE_i \wedge AVE_j \geq \Phi_{ij}^2$?
B ← A	0.335	0.112	0.786	0.882	OK
B ← G	0.540	0.292	0.786	0.916	OK
B ← E	0.178	0.032	0.786	0.781	OK
B ← M	-0.195	0.038	0.786	0.870	OK
R ← B	0.682	0.465	0.714	0.786	OK
G ← A	0.652	0.425	0.916	0.882	OK
M ← E	0.380	0.144	0.870	0.781	OK
G ← E	0.176	0.031	0.916	0.781	OK
M ← A	0.411	0.169	0.870	0.882	OK
E ← A	0.103	0.011	0.781	0.882	OK
A ← M	0.202	0.041	0.882	0.870	OK
E ← G	0.039	0.002	0.781	0.916	OK
A ← E	0.385	0.148	0.882	0.781	OK
M ← G	-0.221	0.049	0.870	0.916	OK
G ← M	-0.144	0.021	0.916	0.870	OK

On the other hand, from the table values of *Squared Multiple Correlations* calculated by IBM® SPSS® Amos, was elaborated a summary depicted in **Table VII**.65 for all endogenous latent variables of the model. Observe that in this theoretical scenario there is no exogenous latent variables.

Table VII.65 – Variance explained by endogenous latent constructs for *Dynamic Scenario* (φ_n)**,** ($\boldsymbol{n = 118}$)**. Source:** Own elaboration from AMOS.

Endogenous latent variables	% of explained variance by the model
Effects of environmental factors [E]	14.0
Effects of moderator factors [M]	45.5
Agile capabilities [A]	41.9
Governance capabilities [G]	48.6
Business operations [B]	70.8
Value delivery [R]	46.5

We have found that only 70.8% of the variation of Business operations [B] and 46.5% of the variance of Value delivery [R] can be explained by the model proposed for Dynamic Scenario (φ_n). It is a high explanatory power, for more than half of business operations [B], as well as for almost half of value delivery [R], can be measured by changes in the constructs included in the modeling, the remaining variance (29.2% and 53.5%, respectively for [B] and [R]) is attributed to factors not considered in the model depicted for this scenario. Besides, we can also realize a good explanatory power for the following constructs: [M], [A], [G].

We also have used the same adjustment strategy adopted in previous scenarios, correlating the errors from the manifest variables $\boldsymbol{y_{17}}$ and $\boldsymbol{y_{18}}$ in order to improve the goodness fit indices of the SEM model. After that, the SEM model which describes the current scenario has assumed *acceptable fit indices*, and can be described in terms of *overall acceptable quality adjustment indices*, as already discussed in Section 5.2.5.2.1. The ***quality adjustment indices*** for the current scenario are depicted in **Table VII**.66, as well as the test for each hypothesis depicted in this scenario is available at **Table VII**.67.

Table VII.66 – Quality adjustment indices from model based on *Dynamic Scenario* (φ_n), ($\boldsymbol{n = 118}$). **Source:** Own elaboration from AMOS.

Group Analysis	Indices	Obtained values	Reference values for Analysis	Analysis
Fit tests	*Chi-square* ***(χ^2)***	218.480	lower is better	-
	Degrees of freedom ***(df)***	158	≥1	OK
	p-value	0.001	>0.05	Acceptable fit
Absolute Indices	*Standardized Chi-square* ***(χ^2/df)***	1.383	<3	OK
	Root Mean Square Error of Approximation ***(RMSEA)***	0.057	<0.10	Good fit
	Goodness of Fit Index ***(GFI)***	0.848	>0.90	Acceptable fit
Relative Indices	*Comparative Fit Index* ***(CFI)***	0.948	>0.90	Good fit
	Normed Fit Index ***(NFI)***	0.839	>0.90	Acceptable fit
	Tucker-Lewis Index ***(TLI)***	0.938	>0.90	Good fit
Parcimony Indices	*Parsimony GFI* ***(PGFI)***	0.638	>0.60	Good fit
	Parsimony CFI ***(PCFI)***	0.789	>0.60	Good fit
	Parsimony NFI ***(PNFI)***	0.698	>0.60	Good fit
		Solution is admissible	-	Acceptable fit

Regards to the ***hypotheses testing***, in the scenario under analysis there are only ten hypotheses from 16 hypotheses depicted from the emerging theory, which we intend to test. According to the results depicted in **Table VII**.63, only the hypotheses $\boldsymbol{H_6}$, $\boldsymbol{H_{11}}$, and $\boldsymbol{H_{15}}$ could not be confirmed in the **Dynamic Scenario (φ_n)** due to they have no enough statistical significance. On the other hand, the remaining hypotheses in this scenario were confirmed: $\boldsymbol{H_1}$, $\boldsymbol{H_2}$, $\boldsymbol{H_3}$, $\boldsymbol{H_4}$, $\boldsymbol{H_5}$, $\boldsymbol{H_7}$, $\boldsymbol{H_{13}}$ and $\boldsymbol{H_{16}}$.

Table VII.67 – Hypothesis test for *Dynamic Scenario* (φ_n), ($\boldsymbol{n = 118}$). **Source:** Own elaboration from AMOS.

Hypotheses		Dynamic Scenario (φ_n)	Test	Comments
H_1	Agile governance $[G \leftarrow A]$	Significant ($\beta = 0.652$, ***)	Confirmed	N/A
H_2	Agile governance $[B \leftarrow G]$	Significant ($\beta = 0.540$, ***)	Confirmed	N/A
H_3	Specific agility $[B \leftarrow A]$	Significant ($\beta = 0.335$, $p = 0.026$ *)	Confirmed	N/A

Hypotheses		Dynamic Scenario (φ_n)	Test	Comments
H_4	Value delivery $[R \leftarrow B]$	Significant ($\beta = 0.682$, ***)	Confirmed	N/A
H_5	Moderator factors effects $[B \leftarrow M]$	Non-significant ($\beta = -0.195$ $p = 0.100$)	Not confirmed	We have identified the negative influence from [M] upon [B] in current scenario, but the hypothesis has no enough statistical significance.
H_6	Environmental factors effects $[B \leftarrow E]$	Non-significant ($\beta = 0.178$, $p = 0.168$)	Not confirmed	The hypothesis has no statistical significance, and the influence identified from [E] upon [B] by the study was not negative, as would be originally expected. In fact, when we realize that not only threats (negative influence) from Environmental factors effects [E] can jeopardize Business operations [B], but also opportunities (positive influence) can potentiate it. This evidence is supported by the emerging theory.
H_7	Moderator factors effects $[A \leftarrow M]$	Non-significant ($\beta = 0.202$, $p = 0.233$)	Not confirmed	The hypothesis has no statistical significance, and the influence identified from [M] upon [A] by the study was not negative, as would be originally expected. This result leads us to think whether: (1) it would be this one occurrence of the behavior changing from Moderator factors effect [M] into enabler ones, such as when it is empowered by the combination of agile and governance capabilities; or, (2) whether, this result can be a consequence of the multiple organizational context shuffled into the data sample; or even, (3) this evidence can be an effect from the wording (quite generic questions) we have asked on the questionnaire. Regardless any of these hypotheses, this denotement has to be further investigated in future studies.
H_8	Moderator factors effects $[G \leftarrow M]$	Non-significant ($\beta = -0.144$, $p = 0.383$)	Not confirmed	Although we have identified the negative influence from [M] upon [G] in current scenario, the hypothesis has no enough statistical significance.
H_9	Environmental Factors effects $[A \leftarrow E]$	Non-significant ($\beta = 0.385$, $p = 0.081$)	Not confirmed	The hypothesis has no statistical significance, besides the influence identified from [E] upon [A] by the study is positive, instead of negative, as depicted in the statement of the hypothesis. This result lead us to think that not only threats (negative influence) from Environmental factors effects [E] can jeopardize Agile capabilities [A], but also opportunities (positive influence) can potentiate it. This evidence is supported by the emerging theory.

Hypotheses		Dynamic Scenario (φ_n)	Test	Comments
H_{10}	Environmental factors effects [$G \leftarrow E$]	Non-significant ($\beta = 0.176$, $p = 0.436$)	Not confirmed	In spite of the hypothesis has no statistical significance, the influence identified from [E] upon [G] by the study is slight and positive. In fact, when we realize that not only threats (negative influence) from Environmental factors effects [E] can disturb Governance capabilities [G] development, but also opportunities (positive influence) can leverage it. This evidence is supported by the emerging theory.
H_{11}	Environmental factors effects [$M \leftarrow E$]	Significant ($\beta = 0.380$, $p = 0.027*$)	Confirmed	We have identified the positive influence from [M] upon [E] in current scenario, and the hypothesis has enough statistical significance.
H_{12}	Sustainability [$M \leftarrow A$]	Non-significant ($\beta = 0.411$, $p = 0.055$)	Not confirmed	We have identified the positive influence from [A] upon [M] in current scenario, but the hypothesis has no enough statistical significance.
H_{13}	Competitiveness [$E \leftarrow A$]	Non-significant ($\beta = 0.103$ $p = 0.729$)	Not confirmed	We have identified a slight positive influence from [A] upon [E] in current scenario, but the hypothesis has no enough statistical significance.
H_{14}	Sustainability [$M \leftarrow G$]	Non-significant ($\beta = -0.221$ $p = 0.246$)	Not confirmed	The hypothesis has no statistical significance, besides the influence identified from [G] upon [M] is negative, instead of positive, as depicted in the statement of the hypothesis. On the other hand, we can interpret the negative influence evidenced as the expected nullification effect from [G] on [M], stated by the current hypothesis. This finding is supported by the emerging theory.
H_{15}	Competitiveness [$E \leftarrow G$]	Non-significant ($\beta = 0.039$, $p = 0.896$)	Not confirmed	We have identified a little positive influence from [G] upon [E] in current scenario, but the hypothesis has no enough statistical significance.

Hypotheses		Dynamic Scenario (φ_n)	Test	Comments
H_{16}	Agile Governance mediation $\begin{bmatrix} A & & \\ \downarrow & \searrow & \\ G & \rightarrow & B \end{bmatrix}$	• **Sobel test:** ▪ For $\alpha = 0.05$, $\lvert Z \rvert = 2.829 > Z_{0.975} = 1.96$, $p = 0.005$ **: significant • **Bootstrap test:** ▪ For $p_{A\rightarrow B} = 0.012$ **, $p_{G\rightarrow B} = 0.004$ ** *: significant	Confirmed by both tests	The Governance capabilities [G] has an mediation effect of the Agile capabilities [A] upon the Business Operations [B]. In other words, the total effect caused by [A] on [B] can be separated into direct effect of trajectory [A→B] ($\beta_{A\rightarrow B} = 0.335$; $p < 0.026$ *), as well as the indirect effect of the trajectory described by [A→G] ($\beta_{A\rightarrow G} = 0.652$; $p < 0.001$***) and [G→B] ($\beta_{G\rightarrow B} = 0.540$; $p < 0.001$***). Cohen et al. (2003) suggest that when all trajectories between mediators are significant, then the global mediation effect is also significant. As pointed out by Little et al. (2007), a *partially mediated relationship* is indicated if the direct effect of the mediator construct,[G], accounts for a significant amount of variance in [B], while the direct effect of the predictor construct [A] remains significant. Based on those results, we can also imply that the effect of Agility [A] on Business Operations [B] has an greater intensity when applied by means of the mediation of Governance capabilities [G], than when applied directly upon [B]. These findings are empirical evidences from the plausibility of: 1st Law, 2nd Law, and theory's premises.
	Statistics	**Passed**: 6/16 **Refuted**: 10/16	-	-
	Analysis	38% success	-	-

Glossary

When the citation is not explicit, the definition was result of the multiples findings from the overall Bibliography of this thesis. Thus, some of these definitions and explanations were crystallized during the synthesis process of this research.

Concept	***Definition***
Agile capabilities [A]	*The ability to acquire, develop, apply and evolve competencies related to principles, values and practices, from agile and lean philosophies on organizational context.*
Agile enterprise	*Firm that has developed organizational agility, built on policies and processes that facilitate speed and change, it aims to achieve continuous competitive advantage in serving its customers. Agile enterprises use diffused authority and flat organizational structure to speed up information flows among different departments, and develop close, trust-based relationships with their customers and suppliers.*
Agility	*The ability of an organization to react to changes in its environment faster than the rate of these changes Kruchten (2011) [S92].*
Business agility	*The ability to deliver value[84] faster, better, and cheaper to the business (Luna et al., 2014b).*
Business operations [B]	*It is the set of organized activities involved in the day to day functions of the business, conducted for the purpose of generating value delivery, including (but not limited to): processes, functions, services, products, projects, practices, and behaviors. Those activities depends on the nature of the core business of the organization.*
Competitiveness	*The ability to maintain itself able to compete in any conditions in any market. The ability of a firm or a nation to offer products and services that meet the quality standards of the local and world markets at prices those are competitive and provide adequate returns on the resources employed or consumed in producing them. Competitiveness is defined by the productivity with which a nation or a firm utilizes its human, capital and natural resources.*
Core business	*It is the "raison d'être" of any organization, the cause of its existence. For instance, in case of a company may be the target activity to achieve profit, for a NGO might be a variety of service and humanitarian functions, concerning to governments should be initiatives to accomplish the welfare of its citizens.*
Effectiveness	*The degree to which something is successful in producing a desired result; success: "the effectiveness of the business operations".*
Effects of environmental factors [E]	*The effects sensed by the organizational context, as a result of the influence caused by the external environment in which the organizational context resides.*
Effects of moderator factors [M]	*The effects sensed by the organizational context as a result of the influence caused by factors that tend mediate, inhibit or restraining the organizational performance. The nature of these factors varies according to the particularity of each organizational context.*
Efficiency	*It is the degree of comparison of what is actually produced or performed with what can be achieved with the same consumption of resources (money, time, labor, etc.). It is an important factor in determination of productivity. Lays the groundwork on how critical business decisions regarding resource allocation are made.*
Enterprise agility	*It is the firm's ability to act and react rapidly, flexibly and robustly in response to unexpected challenges, events, and opportunities.*

[84] "An informal term that includes all forms of value that determine the health and well-being of the firm in the long run." (BD, 2013)

Concept	Definition
Governance capabilities [G]	*The ability to acquire, develop, apply and evolve competencies related to the way as an organizational context is conducted, administered or controlled, including the relationships between the distinct parties involved and the aims for which it is governed.*
Internal Organizational Environment	*It is the social, economic, cultural, technological and political inner environment belonging to the organizational context.*
Leagile	*It is a hybrid of lean and agile systems or approaches [S165].*
Organizational aglity	*The ability of an organization to respond quickly and effectively to unanticipated events in its environment Thomsett (2013).*
Organizational competitiveness	*The ability to establish and maintain the organizational context able to compete in any circumstances, especially in turbulent and dynamic environment.*
Organizational context	*It is the environment comprised by the influence of social, economic, cultural, technological and political aspects related to positions and roles on individuals of a group, and refers to the scope of an institution; insofar it can be, in increasing order of complexity: team, project, business unit, enterprise, or a multi-organizational setting.*
Organizational sustainability	*The ability to establish and maintain the harmony and productivity of the organizational context at a certain rate or level, conserving a balance by avoiding depletion of resources: time, team motivation and energy, among others.*
People engagement	*Regards to the emotional connection an employee, collaborator and/or partner feels toward his or her organization, which tends to influence his or her behaviors and level of effort in work related activities. For instance, the more engagement an employee has with his or her company, the more effort they put forth. This engagement also involves the nature of the job itself, e.g., if the employee feels mentally stimulated; the trust and communication between employees and management; ability of an employee to see how their own work contributes to the overall company performance; the opportunity of growth within the organization; and the level of pride an employee has about working or being associated with the company.*
Steering System	*It is the system that describe as an organizational context is conducted, administered or controlled, including the relationships between the distinct parties involved and the aims for which it is governed (such as: processes, policies, laws, customs and institutions).*
Strategic flexibility	*Given the constantly changing environment, the ability of a company to change direction quickly and reconfigure its strategy is essential to succeed in realizing a sustainable competitive advantage. In other words, companies must have a strategic flexibility.*
Sustainable cycles	*Refers to the establishment of sustainable cycles of iteration and organizational development during theory application.*
Value delivery [R]	*The ability to generate results (and become persistent the benefits arising from them) to the business by means of the delivery of value, whereas includes all forms of value that determine the health and well-being of the organization in the long run.*