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INFLUENCES ON ORGANISATIONAL SLACK IN NEW PRODUCT DEVELOPMENT PROJECTS

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Programs to decrease cost and to increase operational efficiency may reduce a company's ability to innovate, by reducing organisational slack. Previous research on the relationship between organisational slack and innovation has been at level of the firm and has neglected the processes underlying the relationship, which takes place at the level of product development projects. In this paper, we identify organisational slack and its influences at the level of the product development project. Through exploratory case research in high-velocity industries, two influences on organisational slack are identified: customer interaction and top management control. We also identify two categories of organisational slack at the product development project level: project deliverables and human competences. The two influencing variables and the two categories of organisational slack all have an effect on the knowledge creation taking place inside the projects and therefore ultimately innovation.

Keywords: Organisational slack; knowledge creation; innovation; product development; projects; case study research.

Introduction

Our overall concern of this paper is with a company's ability to reduce cost and to increase efficiency while retaining the ability to innovate; that is, the ability to maintain innovation while reducing organisational slack (Geppert, 1996; Lawson, 2001;

Meyer, 1982; Nohria and Gulati, 1996; Sharfman *et al.*, 1988). Reducing organisational slack is an attempt at reducing resources in excess of those required to produce necessary outputs (Bourgeois, 1981; Cyert and March, 1963/1992). However, increasing efficiency through reducing organisational slack may risk short-term problem-solving being prioritised over solving and handling long-term problems, damaging long-term strategic thinking. Another risk is that creativity and idea generation are not given enough room in the organisation, since there is only time for the most necessary activities (Amabile and Conti, 1999). The consequence of both the risks will be a reduction in innovation, since slack provides resources for search and experimentation (Dougherty and Bowman, 1995; Fisher and White, 2000).

The relationship between organisational slack and innovation has since long been proposed in literature (Cyert and March, 1963/1992; Damanpour, 1991; Singh, 1986), but has until relatively recently not received much empirical support. Recent research has found that the relationship between organisational slack and innovation is inversely U-shaped (Geiger and Cashen, 2002; Nohria and Gulati, 1996; Tan, 2003; Tan and Peng, 2003). With too little organisational slack, innovation is hampered since the uncertainty of success leads to the discouragement of experimentation. When there is too much organisational slack innovation suffers, since the discipline exercised over projects is decreased. The challenge for companies is to find a balance between reducing slack, while at the same time maintaining an ability to innovate (Bourgeois, 1981; Geiger and Cashen, 2002; Nohria and Gulati, 1996, 1997).

Previous studies on the relationship between organisational slack and innovation have been at the firm level, attempting to identify a level of slack that leads to a certain innovation outcome (Geiger and Cashen, 2002; Kuitunen, 1993; Nohria and Gulati, 1996; 1997; Singh, 1986). Organisational slack in these studies is measured utilising financial data, identified in annual reports. Illuminating as they are, these studies do not address the nature of the relationship between organisational slack and innovation at the level of the new product development project. This gap in our knowledge constitutes an important research opportunity, since it is at the level of the new product development project that much of innovation in companies takes place (Goffin and Mitchell, 2005, pp. 23–26).

Our aim in this paper is to identify organisational slack and its influences, at the level of the new product development project. The starting point for identifying organisational slack and its influences is through the effect that organisational slack has on knowledge creation inside the new product development projects. Linking organisational slack to knowledge creation will ultimately increase our understanding of the relationship between organisational slack and innovation, for two reasons. Firstly, knowledge and knowledge creation are key resources for innovation (Grant, 1996b; Kogut and Zander, 1992; Spender, 1996; Teece, 1998; Zander and

Kogut, 1995). Secondly, both knowledge creation and innovation take place inside new product development projects (Nonaka, 1994; Nonaka and Takeuchi, 1995). To identify organisational slack and its influences we conducted exploratory case research in six product development projects.

The paper is organised as follows. We start by making a theoretical review. Key in this review is discussing the relationship between organisational slack and innovation at the firm level, followed by a discussion of firm-level organisational slack and the dependent variable in our research, innovation, which we operationalise as knowledge creation. We then go on to explain how we collected and analysed data. This leads to our empirical findings, from which we draw more general conclusions on the categories of organisational slack and its influences at the level of product development project. Finally, we discuss managerial implications and directions for future research.

Theoretical Review

Organisational slack and innovation at the firm level

Organisational innovation has been associated with different organisational factors such as technical knowledge resources, administrative intensity and specialisation (Damanpour, 1991). Most importantly, for our purposes, organisational slack has been used to explain outcomes in innovation (Nohria and Gulati, 1996). Existing studies on the relationship between organisational slack and innovation have been at the firm level. The focus has been on examining the level of slack, which is supposed to lead to a certain innovation outcome (Geiger and Cashen, 2002; Kuitunen, 1993; Nohria and Gulati, 1996; 1997; Singh, 1986). Two conflicting views on the relationship between organisational slack and innovation exist in the literature: one view is that slack is necessary for organisational adaptation and renewal, the other view is that slack is negatively related to innovation as it is unnecessary and a form of inefficiency (Nohria and Gulati, 1996).

Advocates of slack argue that slack can free up resources necessary for creative behaviour, which can create new innovations (Singh, 1986). Slack allows an organisation to enter new markets, experiment with new strategies and conduct innovative projects that would not be approved of in an environment where there was a lack of slack (Cyert and March, 1963/1992, pp. 188–190; Hambrick and Snow, 1977). Slack has a positive effect on innovations for three reasons (Nohria and Gulati, 1996). Firstly, it relaxes the controls and serves as a fund that may be used even in uncertain situations. Secondly, it frees up managerial attention, which is generally a scarce resource. Thirdly, it allows projects to continue even though their success is uncertain.
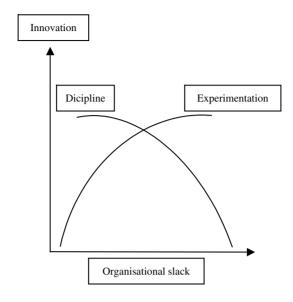
Fig. 1. The relationship between slack and innovation, adapted after Nohria and Gulati (1997).

Critics of organisational slack argue that it there is more slack, then there is less innovation (Liebenstein, 1969). Slack is here seen as an unnecessary cost that detracts value from the overall value of the company and as a consequence should be eliminated. Too much slack leads to a lack of discipline that makes bad projects survive. Firms with high amounts of slack invest in dubious R&D projects and have difficulties in exiting unsuccessful projects (Jensen, 1993).

These two views seem to stand in conflict with each other. On one hand it is important for a company to have slack in order to be innovative, but on the other hand slack is some sort of inefficiency. Addressing this apparent conflict, Nohria and Gulati (1996) found that the relationship between slack, and innovation is inversely U-shaped (∩). When there is too little slack innovation is hampered due to the uncertainty of success, and so experimentation is discouraged. When there is too much slack, the discipline exercised over projects is decreased. Thus, there is an optimum level of slack (see Fig. 1).

The findings by Nohria and Gulati (1996) have been supported and refined by Geiger and Cashen (2002) who took a multidimensional perspective on organisational slack and examined the relationship between innovation and, in turn, available, recoverable and potential slack. They found an inverted U-shaped relationship between innovation and both available and recoverable slack. They also found a linear relationship between innovation and potential slack — the greater the level of potential slack (less debt/equity), the greater the innovation within the firm. A complementary view of the relationship between organisational slack and innovation is

offered by Judge *et al*. (1997), who argue that it is not the level of slack as such that is important; rather it is the continuity of slack. Their view is that to attain high levels of innovation it is necessary for organisational slack not to be constantly threatened.

Defining categories of organisational slack at the firm level

Innovation apart, the concept of organisational slack has been used to explain various organisational phenomena (Cyert and March, 1963/1992, p. 43). Organisational slack has been used to explain top management teams' strategic and political behaviour (Bourgeois and Singh, 1983), risk-taking (Bromiley, 1991; Palmer and Wiseman, 1999; Singh, 1986; Wiseman and Bromiley, 1996), environmental management issues (Bowen, 2002) and firm performance (Greenley and Oktemgil, 1998). There is also literature that examines the concept of budgetary slack (Merchant, 1985), where the focus is on managers' intentional use of the budget process to create and bargain for slack budgets. This is then related to areas such as budgetary participation (Dunk and Perera, 1997), managerial short-term orientation (Van der Stede, 2000), and the corporate diversification and business unit strategy (Van der Stede, 2001). Finally, organisational slack has been seen as a buffering mechanism against changes in an organisation's external surroundings (Sharfman *et al.*, 1988; Thompson, 1967),

The diversity of phenomena to which organisational slack has been applied means that there are different views of and definitions of the concept. Therefore, defining organisational slack is associated with both conceptual and empirical difficulties (Nohria and Gulati, 1996, p. 1246). An often-used definition has been proposed by Bourgeois (1981, p. 30), who defines organisational slack as "… *that cushion of actual or potential resources which allow an organization to adapt successfully to internal pressure for adjustment or to external pressure for change in policy, as well as to invite changes in strategy with respect to the external environment*". This definition implies that slack or spare resources are accumulated to adapt to future changes in the environment. The purpose of slack is to allow the organisation to forego short-term gains in favour of long-term gains. Slack resources are not committed to necessary expenditure, but are built up for future use (Sharfman *et al.*, 1988).

The majority of studies of organisational slack and innovation equate organisational slack with financial resources (Bourgeois and Singh, 1983; Bromiley, 1991; Cheng and Kesner, 1997; Geiger and Cashen, 2002; Greenley and Oktemgil, 1998; Kuitunen, 1993; Palmer and Wiseman, 1999; Riahi-Belkaoui, 1998; Singh, 1986; Wiseman and Bromiley, 1996). These studies have used financial data to examine the level of slack, which is then related to innovation outcomes at the level of the

firm. The use of financial information as an indicator of slack has been concerned both with the present status of the firm as well as the firm's long-term capabilities (Love and Nohria, 2005). Bourgeois and Singh (1983) argue that slack can be differentiated on an ease-of-recovery dimension; that is, a continuum representing how quickly the slack resource can be recovered for potential redeployment. They conceptualised the ease-of-recovery dimension into available (readily), recoverable (with some effort) and potential slack. *Available slack* is measured as the current ratio (current assets/current liabilities), *recoverable slack* as selling and general administrative expenses divided by sales (S&GA/sales) and *potential slack* is measured as the company's dept to equity ratio.

Although the view of organisational slack as being related to (financial) resources dominates the literature, there are other views of organisational slack (Geppert, 1996; Lawson, 2001; Meyer, 1982; Nohria and Gulati, 1996; Sharfman *et al.*, 1988). Therefore, there is a need to go beyond focusing solely upon financial data, to include other aspects. In our review of the literature on organisational slack we identified two additional categories of organisational slack at the firm level: time and personnel (Bourgeois, 1981; Cyert and March, 1963/1992; Love and Nohria, 2005). Regardless of category, slack is used by the organisation to adapt to changes. These changes can be external to the organisation, such as environmental jolts — sudden and unpredictable events (Meyer, 1982). The changes can also come from inside the organisation, in the form of internal pressure for adjustment (Bourgeois, 1981).

The availability of time that is not fully engaged in the current delivery of the organisation's primary product or service is a second category of organisational slack (Geppert, 1996; Lawson, 2001). The importance of time as a category of organisational slack is emphasised by studies on innovation projects, particularly bootlegging projects (Augsdorfer, 2005). In bootlegging projects slack resources necessary for innovation are for the most part time and to a lesser extent budgets. Organisational slack, in terms of time, is needed for the members of the organisation to learn from experience, to adapt to environmental changes and be innovative (Lawson, 2001, pp. 126–127). The organisation's members need slack time to reflect, analyse and discuss (Lawson, 2001). It is difficult to create knowledge if the members are hurried or rushed. However, knowledge creation does not happen automatically just because there is time available. The organisation must give its members room to develop and collaborate (Stewart, 1996). The availability of time is closely related to goals and deadlines (Cyert and March, 1963/1992; Nohria and Gulati, 1996).

The third category of firm-level organisational slack is personnel; excess, removable personnel (Love and Nohria, 2005) or human resources (Meyer, 1982). These studies argue that firms can have a surplus of employees (Nohria and Gulati, 1996;

1997), which in turn affects innovation. However, recent research has shown that downsizing which is focusing solely on reducing personnel is unlikely to result in improved performance since personnel are often embedded in organisational routines, processes and structures, that have to be changed as well (Love and Nohria, 2005).

Apart from the identifying three categories of organisational slack, financial resources, time and personnel, existing literature contains surprisingly few discussions of what actually influences each of these three categories of organisational slack. A notable exception is Cyert and March (1963/1992) who discuss the exercise of governance and leadership by top management (Cyert and March, 1963/1992) influencing goals and deadlines; that is, slack time resources. A lax governance can result in less stringent demands to meet forecasted deadlines as there is much slack, resulting in more freedom given to individual projects. But it can also be the other way around — the governance of a project can increase, resulting in less freedom as there is less slack (Nohria and Gulati, 1996).

These three categories of organisational slack identified in the literature serve as an important starting point for our research. However, these categories of slack are identified at the firm level. Our research approach differs in four respects. Firstly, instead of measuring and/or identifying categories of slack at the level of the firm, we are interested in identifying organisational slack at the product development project level. Thus, the unit of analysis is not the firm, but product development projects inside the firm. Secondly, our focus on new product development projects means that we are concerned with project *execution* as opposed to project selection, since it is during execution the actual innovation is created (Nonaka *et al.*, 1994). Thirdly, we are interested in identifying both the categories of slack at the product development project level and what influences these categories. The fourth and final difference to existing research is that we conceptualise innovation as knowledge creation.

Effects of organisational slack on knowledge creation and innovation

The conceptualisation of innovation as knowledge creation is linked to the broader literature on organisational learning, which has received increased attention throughout the years (Crossan and Guatto, 1996), particularly since learning organisations are expected to help managers build competitive companies (Ulrich *et al.*, 1993). However, the literature is fragmented, even though attempts have been made trying to synthesise the field (e.g. Crossan *et al.*, 1999; Easterby-Smith, 1997; Easterby-Smith and Lyles, 2003; Easterby-Smith *et al.*, 1998). The major reason for the fragmented view is that no clear distinction is made between learning and knowledge (Vera and Crossan, 2003). Easterby-Smith and Lyles (2003) classify concepts into four categories: (i) "organisational learning", (ii) "learning

organisations", (iii) "organisational knowledge" and (iv) "knowledge management", which help to position important works on learning and knowledge. Our research falls within the category "organisational knowledge" (Easterby-Smith and Lyles, 2003). This stream of research was popularised by Nonaka (1991; 1994; Nonaka and Takeuchi, 1995) in his discussions of knowledge and innovation, in line with the overall goal of our research, to develop our understanding of the relationship between organisational slack and innovation.

Companies' ability to innovate is closely linked to the creation of knowledge (Darroch, 2005; Darroch and McNaughton, 2002; Leonard, 1995; Nonaka and Takeuchi, 1995; Soo *et al.*, 2002). Knowledge has extensively been pointed out as the key resource for innovation (Grant, 1996b; Kogut and Zander, 1992; Spender, 1996; Teece, 1998; Zander and Kogut, 1995). Knowledge creation in particular has been associated with innovation (Nonaka, 1994; Nonaka and Takeuchi, 1995; Nonaka *et al.*, 1994). Knowledge creation has the benefit of viewing knowledge from an "in-between perspective", neither a macro perspective (i.e. firm) (Grant, 1996b; Nahapiet and Goshal, 1998; Spender, 1996) nor a micro perspective (i.e. individual) (Szulanski, 1996; von Hippel, 1994). The literature on knowledge creation is characterised by three things (Crossan *et al.*, 1999):

(1) it is explicitly concerned with product innovation;
(2) it links different levels (individual–group)
(3) it focuses on processes that link individuals and groups to each other, i.e. the focus, or unit of analysis, is within the company.

This choice of perspective on knowledge implies using the product development project as the unit of analysis, not the firm and not the individual (Nonaka, 1994; Nonaka and Takeuchi, 1995). Given the relationship between organisational slack and innovation, we can expect that as organisational slack is reduced, knowledge creation is affected. Previous research has found that companies that downsize, effectively attempting to reduce organisational slack, damage communication and learning networks (Dougherty and Bowman, 1995; Fisher and White, 2000) and may reduce the organisational knowledge in the organisation. This will ultimately affect innovation, as both knowledge creation and innovation take place inside new product development projects.

Following the pioneering work by Nonaka (1994; Nonaka and Takeuchi, 1995), we have conceptualised knowledge creation as the ability to share and transfer knowledge among members in product development projects. The process of creating knowledge takes place in the continuous and dynamic interplay between tacit and explicit knowledge. *Tacit knowledge* is defined as knowledge that is derived from experience and something that is difficult or impossible to articulate in written documents, that is *know-how* (Grant, 1996a). *Explicit knowledge*, on the other hand,

can be found in written documents and can be expressed in totality, that is *know-that* (Grant, 1996a). Yet, it is important to remember that it can be difficult to draw a clear line between tacit and explicit knowledge, and as a consequence they should be seen on a continuum ranging from tacit to explicit (Tsoukas, 1996).

Important to note here is that knowledge creation is not an outcome variable in the sense that we are interested in the exact relationship between organisational slack and knowledge creation. Rather, using knowledge creation is necessary to identify organisational slack. The starting point for identifying organisational slack is through its effect on knowledge creation inside the new product development projects. Being inherently a conceptual phenomenon, organisational slack is not directly observable, but is only observable through its effects. It is through observing the effects on knowledge creation that we can hope to identify organisational slack.

Research Methodology

To identify different categories of slack in product development projects we chose a case study approach. A case study approach is appropriate when the researcher has little control over events and when the goal is to describe incidence or prevalence of phenomena (Leonard-Barton, 1990) and when data is obtained from multiple levels and perspectives (Voss *et al.*, 2002). The unit of analysis in case research is the case study itself (Voss *et al.*, 2002) and as a consequence different cases from the same company can be used to study different issues, or the same issue can be researched in a variety of contexts in the same company (Pettigrew, 1990). The latter approach is taken in this study.

Sample selection

The objective of using theoretical sampling is to find cases that can be expected to replicate or extend emergent theory. Eisenhardt (1989, pp. 536–537) argues that the aim of theoretical sampling is to find a reference population, assuming that the cases are not chosen randomly. Specifying a research population by using different sampling criteria reduces extraneous variations and relates the findings to a specific well-defined domain (Laverty, 1996). The reference population in this study consists of companies, but the companies are not the same as cases. The cases are product development projects inside the companies (Voss *et al.*, 2002). As a result it is possible to have more than one case inside one company.

Four different criteria were used to find the reference population: (1) listed companies, (2) clockspeed, (3) existence of R&D, and finally, (4) number of employees. The sampling criteria and their operationalisation are summarised in Table 1 and are developed later.

Table 1. Sampling criteria: Summary of the four sampling criteria used to identify the reference population and the resulting number of companies.

	Criterion	Description	Number
1	Listed	Listed companies on the Stockholm Stock Exchange by 30 June 2001.	379
2	Clockspeed	Information technology, telecommunication, and media and entertainment following standard classifications.	119
3	R&D	Companies that have entered an amount for their R&D expenses in their income statement (i.e. excludes companies that have included their R&D costs in employee expenses).	30
4	Employees	Companies with 1, 000 employees or more have been included.	7

Only *listed companies* are included in the reference population for two reasons: (1) economic short-termism and (2) information. Economic short-termism is the dilemma where the best course of action in the short term is not desirable, because it is suboptimal in the long run (Laverty, 1996). This is a dilemma faced by companies under pressure from the stock market to maintain and increase year-to-year or quarter-to-quarter profit (Hayes and Abernathy, 1980). The purpose of organisational slack is to allow the organization to forego short-term gains in favour of long-term outcomes (Bourgeois, 1981), which is the opposite of economic short-termism. Therefore, we would expect it to be easier to identify (the absence of) organisational slack in listed companies. The second reason for choosing to include only listed companies is that they are compelled to provide a minimum amount of information due to stock market rules and are more visible in the press as they are analysed and commented on. This provides background information that might be difficult to find for unlisted companies.

Only companies listed in Sweden were included in the study, due to ease of access and research budget constraints. The sample includes companies listed on the Stockholm Stock Exchange and the NGM Equity Market, on 30 June 2001. Companies listed on other marketplaces are not considered due to low turnover at these marketplaces. Neither have companies that were listed after June 2001 been included in the reference population.

Clockspeed refers to the speed of change in the business environment (Fine, 2000; Mendelson, 2000; Mendelson and Pillai, 1998). Choosing *fast-clockspeed industries* is related to choosing cases where progress is transparently observable (Pettigrew, 1990). Biologists who want to learn about the human evolution often study fruit flies, a species with a short life cycle. The fast rate of evolution of the fruit

flies permits rapid learning for the scientists that can be applied to understanding of slower-clockspeed species, for example human beings. Fine (2000) argues that a researcher can learn a lot by applying the ideas of clockspeed to industries. In industries with fast clockspeed, the rate of change in the external environment, such as technology development, consumer preferences and market conditions, exceeds that of other industries. The opportunity to study an industry that repeats its cycle of change rapidly provides the researcher with the opportunity to develop theories about the cause and effect of changes (Christensen, 1997). By studying rapidly evolving or fast-clockspeed industries it is possible to anticipate development in other industries.

Three different industries were considered to match the criterion of having rapid changes in the external environment, consumer preferences and market conditions. The choice of industries followed the classification in *Affärvärlden* (one of the leading weekly business magazines in Sweden), which is widely used to make classifications such as this. Three different fast-clockspeed industries were identified: information technology (76 companies), telecommunication (29 companies), and media and entertainment (14 companies).

The *existence of R&D* in the company is the third criterion for finding the reference population, since we are interested in identifying categories of slack in product development projects. Only companies that entered an amount for their R&D expenses in the annual report for the year 2000 were considered. The logic behind this criterion is that the company should have an idea about how much they spend on R&D and not include it in other expenses as an overhead cost. Another motive is that companies that do only consulting should not be included. No limit was set on the R&D expenditure as a fixed percentage of the total turnover. The reason is that many companies had already been excluded on the basis of whether or not they had R&D expenditures.

The final sampling criterion was the *number of employees* in the company. To be included in the sample the company must have *at least 1,000 employees*. The generalisibility of the results found in a company with less than 1,000 employees is limited for various reasons such as they may only sell and develop one product or they may not produce the products they develop. There will also be fewer product development projects to choose to include in the study.

As the four sampling criteria are considered seven companies remain as the reference population (see Table 2). We deliberately contacted the companies that were of most polar types. Since we conducted theoretical sampling, and not statistical sampling, this was a conscious choice. We wanted to maximise our chances of observing relevant phenomena (Pettigrew, 1990). For reasons of confidentiality and to gain access, we also decided to exclude direct competitors. This left us with four companies. Four of these were contacted and two agreed to participate in the

Table 2. *Research sample*: Information about the two companies and the projects.

Support inc.	Communication supplier
Global software firm developing and supplying a collaborative enterprise application	Develop markets and manufactures communication products worldwide
Four product development projects	Two product development projects
• Three platform and one derivative	• One platform and one derivative

study. The two companies are made anonymous at their own request and are called Support Inc. and Communication Supplier.

We chose multiple cases to avoid the limitations of using a single case, such as limits in generalisations and other potential biases (Yin, 1994, pp. 45–46), and also to produce more robust results (Pettigrew, 1990). As the unit of analysis is the product development project, it was possible to identify more than one case within one company. After initial discussions with Support Inc. and Communication Supplier six cases where chosen (four in Support Inc. and two in Communication Supplier) on the basis that the cases should be of polar types (Pettigrew, 1990) considering such things as size, number of project members, budget, the type of product being developed and the importance of the project to the company. All of the six projects were ongoing projects at the outset of the present study. However, the histories of the projects have also been reviewed to gain a deeper understanding of the projects.

Data collection

The first step in collecting data was developing a case study protocol, containing the research variables to address. The research variables in focus were (i) organisational slack, building on the review of the categories of organisational slack at the firm level; (ii) innovation; and (iii) project information (e.g. size, budget, timeframe, type of project, etc.). The research variables were used to direct our attention during data collection, since collecting data requires the formulation of what to look for (Eisenhardt, 1989). However, while data collection needs to be systematic, exploratory case study research requires the researcher to be flexible, to incorporate the importance of allowing for inductive enquiry (Mintzberg, 1979).

As this research is exploratory we wanted to have the possibility of following up leads in other directions than those which formal research variables indicated. For this reason, we used semi-structured interviews during data collection. This helped us to gain a better understanding of the history of the companies, the respective

projects and the practices used. Furthermore, in the case study protocol some of the questions on each of the research variables overlapped. For instance, it was possible to have answers from the respondents on innovation while asking a question on the project and vice versa. Thus, while the case study protocol was our starting point, flexibility was retained to incorporate observations that related to organisational slack.

Our main source of information was thus semi-structured interviews, but we also gathered data through different project protocols. Finally, we made continuous reviews of information about the companies in the business press and company documents to gain an understanding of the companies' context. The purpose of using multiple data collection methods was to achieve triangulation to enhance the confidence in the findings (Eisenhardt, 1989; Jick, 1979).

We completed a total of 46 hours of 30 semi-structured interviews, with 21 respondents, 11 at Support Inc. and 10 at Communication Supplier. The respondents had different backgrounds and came from different levels, ranging from R&D manager to project members. The number of respondents was determined using the criteria of theoretical saturation (Glaser and Strauss, 1967); that is we kept on adding interviews until we had reached a level where additional interviews did not add anything to the characteristics of the emerging constructs. At the beginning of each interview we asked the respondent to describe the project. This was complemented with questions concerning slack and innovation. Since organisational slack is a theoretical concept we deliberately did not ask questions relating to the concept, but more practically oriented questions.

Data reduction and analysis

In this section we describe the process of data reduction and analysis. Data reduction is the preliminary stage of the analysis and consists of selecting, focusing, simplifying, abstracting and transforming the data that appears in written-up field notes or transcriptions (Miles and Huberman, 1994, p. 10). After data reduction, the analysis is taken one step further by searching for cross-case patterns, in order to go beyond initial impressions (Eisenhardt, 1989).

Since our research is exploratory and theory building, the analysis process contained a constant interplay between theory and data. In our research the interplay took place through a five-step data reduction and analysis process that is summarised in Fig. 2.

The starting point of our research was previous literature on organisational slack (step 1). In the literature review we identified three categories of organisational slack at the firm level. The categories of slack served as an input to the questions we asked during our interviews.
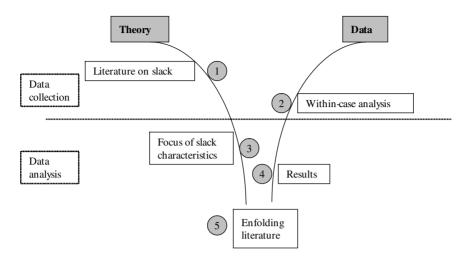
Fig. 2.   The interplay between theory and data in the research process.

Once the data had been gathered we developed within-case analysis (step 2), by coding the data and developing detailed descriptions of each case. The data from each of the six different cases were reduced across three sets of research variables: organisational slack, innovation and project information. We transcribed all interviews and used the qualitative text-analysis computer program N-Vivo to code the interviews. The coding was done using the case study protocol as a template, making it possible to identify patterns as several respondents discussed similar issues. At the end of the study we had developed seven main categories and a total of 71 subcategories (coded in different levels). From the coded data we developed detailed case study write-ups for each of the six cases. The case write-ups included not only information from the interviews, but also written material we had access to. Each of the case write-ups were around 20-page long. The case write-ups enabled us to not only see unique patterns, through becoming intimately familiar with each case (Eisenhardt, 1989), but also to see information on the same theme from different categories (data triangulation) (Jick, 1979; Yin, 1994, pp. 91–93).

Step 3 in the analysis process meant going back to the literature and the three categories of slack and comparing the literature with our findings in step 2. However, as step 2 only contained a within-case analysis, it was necessary to go deeper in the analysis and search for cross-case patterns (steps 3 and 4). As indicated in Fig. 2, steps 3 and 4 were highly interrelated and were performed iteratively, a constant interplay between theory and data. When identifying the categories of organisational slack at the project level, a key question was their effect on the knowledge creation in the projects.

In step 3 of the analysis process we performed cross-case analysis. In this step we searched for patterns that cut across the six cases. We conducted the cross-case analysis using Excel as a tool. Using the case writeups, built on the research categories, each case was broken down in two steps. Firstly, each part identified as belonging to one of the three research variables (organisational slack, innovation, and project information) were coded into respective category. Secondly, each case was further broken down and the respective parts were coded into subcategories. All together the three main categories had 27 subcategories. Thus, a clear reduction in the total number of categories compared to the dataset in N-Vivo, making it possible to compare and analyse across the cases and identify patterns, and also helping us to go beyond the initial impressions (Eisenhardt, 1989).

Using cross-case analysis was important, since we chose the companies and projects to study based on theoretical grounds. Therefore, it was necessary to include all cases to gain confidence in our results. We used the three categories of slack as the point of departure. However, as we analysed the cases we found that the three categories of slack could be identified, even though we argue that time and personnel as being slack resources needs to be developed further when examined at the level of the product development project. Additionally, we found that the three categories of slack were highly influenced by interaction with customers and top management control. The identified categories of slack and its influences were, in step 5 of the analysis process, compared with and related to other theories. The purpose of this step was to help increase the general nature of the findings and also to help explain them. We used both previous theories on organisational slack and product development theory.

Data

Before going into the details of our findings, the two companies in the study are presented in this section: Support Inc. and Communication Supplier. We also present the six projects included in our study. The presentation is structured around the categories of organisational slack that were found in previous literature. To this structure we added the following: (1) a comment on when the *projects started* as a background variable and (2) to separate project governance from project leadership. As we see it, governance is more related to top management and leadership is related to the project leader(s). The *financial resources* in the projects are not included, since the companies did not want to reveal the financial resources in each project and their changes over time. However, by looking at the members in the projects and the top management governance, it was possible to get an indication of the financial resources in each project.

Support Inc.

Support Inc. is a global software company developing and supplying a collaborative enterprise application. The R&D centre is located in Sweden and is divided into a research department and a development department. The research department develops both new functions that are not yet part of the existing enterprise application and new tools that will make it easier to work with the enterprise application, such as a new coding language. The research department always tries to be at the forefront of technological advancement. Consequently the projects performed at the research department are platform projects.

The main task of the development department is to work on the existing enterprise application, about half the time is devoted to supporting the existing product, resulting in new releases of the product. The rest of the time is devoted to development of the product. The result of this work is new versions of the enterprise application. The work done by the research department on finding new functions are also incorporated in new versions of the enterprise application. We examined two projects in the research department (the Component project and the Java project) and two projects in the development department (the Integration project and the Java project). The characteristics of the studied projects are summarised in Table 3.

Communication Supplier

Communication Supplier develops markets and manufactures communication products to firms all over the world. The R&D centre is located in Sweden and is divided into four divisions based on the type of product. In each division, the projects are informally classified as research or development projects. The research projects try to be close to the technological front, while the development projects are projects that are either (a) developed in close collaboration with existing customers or (b) developed to be targeted at existing customers. We studied one project at the research department (the System project) and one project at the development department (the Processor project). The characteristics of the projects are summarised in Table 4.

Organisational Slack at the Product Development Project Level

Our aim in this paper is to identify organizational slack and its influences, at the level of the new product development project. In the comparison between Support Inc. and Communication Supplier, as well as between the projects within respective companies, we first identified categories of organisational slack. We could observe all three categories of organisational slack identified in previous literature, looking at organisational slack at the firm level: financial resources, time and personnel.

Table 3. Summary of the four projects at Support Inc.

Characteristic	Component project	Integration project	Message project	Java project
Product (platform or derivative)	*Platform*, developing a tool for enterprise application systems	*Platform*, developing a tool for enterprise application systems	*Platform*, developing a new product for enterprise application systems	*Derivative*, changing the code base in an existing product
Duration	About 1^1/$_2$ years	About 2 years	About 1^1/$_2$ years	About ^{1}/$_2$ years
Customers	*Internal*, the goal was to produce a tool for enterprise application systems	*Internal*, the goal was to produce a tool for enterprise application systems	*External*, the goal was to produce a component in enterprise application systems for new and existing customers	*External*, the goal was to change the code base of an existing product
Members	*15 project members*, with little previous experience of the product	*10 project members*, with little previous experience of the product	*10 project members*, with varied experience in the project group	*15 project members*, with Varied experience in the project group
Top management governance	*Miscellaneous*, Initially little, then increased towards the end. Prioritised project at the end.	*Miscellaneous*, Initially little, somewhat increased towards the end. Not a prioritised project.	*Fairly tight* all through the project. Prioritised project.	*Tight* all through the project. Prioritised project.
Outcome	*Semi-successful*, did reach market, but not on time.	*Successful*, did reach market	*Successful*, did reach market	*Semi-successful*, did reach market, on time, but with a lot of errors.

Table 4. Summary of the two projects at communication supplier.

Characteristic	The processor project	The system project
Product (platform or derivative)	*Derivative*, upgrading a previous product	*Platform*, a totally new product, the Processor project and the System project respectively, for the whole organisation
Duration	About *1 year*	About *2 years*
Customers	*External*, the goal was to make a standard product and then get customer-specific input	*External*, the goal was to make a standard product and then get customer-specific input
Members	*10 project members*, with previous experience of the product	*30 project members*, with little previous experience of the product
Top management governance	*Miscellaneous*, Initially little, then increased, to be reduced again in the end. Prioritised project.	*Little* governance throughout the project. Not a prioritised project.
Outcome	*Failure*, did not reach market	*Failure*, did not reach market

However, both time and personnel need redefinition when looking at the product development project level. We refer to the two redefined categories as *project deliverables* (instead of time) and *human competence* (instead of personnel). Furthermore, our analysis revealed that the categories of organisational slack were influenced by *customer interaction* and *top management control*.

Project deliverables as a category of organisational slack

In line with previous literature on firm-level organisational slack, the effect of project deadlines, (i.e. time), on the creation of knowledge in the projects was observable in all six cases. Especial salient features were the effects of deadlines in the Processor project at Communication Suppliers. Initially the project had no customer signed, which meant that the project could set its own deadlines for when different versions of the products were to be delivered. However, it was relatively easy to move these deadlines, as the project had no clear customer. Once a customer was signed the situation changed totally and the possibility to change the deadlines disappeared, as the customer did not accept late deliveries. For various reasons, the customer decided to end the collaboration, then that the project again had the possibility to change its deadlines. The main reason for changing the deadlines was an ambition in the projects to create a "perfect product" for the market.

However, our observations on the role of deadlines for knowledge creation extended to the functionality of the product being delivered. Thus, there is more to the notion of time being a slack resource than solely deadlines. For instance, an interesting pattern emerged particularly in the analysis of the projects at Support

Inc. The company had a tradition of projects promising to deliver more than they actually did. This was also the case in the projects that we studied. For instance, in the Java project the project manager told us: *"We saw that we could not finish the product in time and therefore we had to cut out parts of the product. It is more important to be on time than that the whole product is finished."* At Communication Supplier, we did not observe the same type of behaviour when it came to changing the functionalities of the projects to meet deadlines. The projects did their best to deliver what they had promised and they also tried to be on time. However, should it come to a choice between delivering a complete product or being on time, project members emphasised that it was more important to be on time than to deliver a complete product.

Both deadlines and the possibility to deviate from delivering the promised product functionality affected knowledge creation. As the pressure on a project to reach stipulated deadlines was increased, there was less room to experiment and to learn from and reflect on previous work. As there was a lack of time the experienced project members also had little time to share their experiences with newcomers in the project, or to reflect and have a dialogue about the product being developed. In addition, little time was given to documentation of the project and to learn and experiment. Concerning the possibility to deviate on functionality, it was particularly the possibility to deviate from the promised functionality did not exist when we observed how teams shifted to a focus on explicit knowledge, which might imply that the project was not able to take new information and knowledge into account.

We could in several instances observe how project deadlines and the possibility to deviate from promised functionality were related to each other. As there were fewer possibilities to deviate from the promised product functionality, by not delivering what was promised, project teams tried to extend the deadlines as a response. Therefore, in relation to their effect on knowledge creation, we see deadlines and functionality as part of the same concept, which we term "project deliverables". This leads us to the following conclusion:

> *The possibility for projects to depart from the promised deliverables, in terms of deadline and/or product functionality, is a category of organisational slack in product development projects.*

The concept product deliverables, as we define it, thus contains two related parts. The first concerns when to deliver the product (i.e. deadlines) and the second concerns what to deliver. Low levels of slack in project deliverables means that there is little possibility to depart from the project deadlines and/or change the promised deliverables.

Comparing our findings with existing literature, the effects of the deadline part of project deliverables on knowledge creation is line with the existing research on

the effect of time on knowledge. If employees are hurried or rushed it becomes more difficult to create knowledge and learn (Garvin, 1993). Time, some would argue, is necessary to reflect and learn from experience, particularly as technologies become increasingly complex (Lawson, 2001). However, this is not to ignore the crucial importance of meeting deadlines and not being late to the market (Vesey, 1991).

Concerning the second part of project deliverables, the possibility to deviate from the promised product functionality, our analysis indicates that the environment in which the companies operate is of importance. In dynamic and uncertain environments[1] significant changes might occur in customer needs (MacCormack *et al.*, 2001), and as a consequence it is necessary to take in new information during a development project. Many models of product development have their origin in environments where the technologies and target markets are relatively well understood, resulting in the well-known stage-gate process (MacCormack*et al.*, 2001). However, these models do not seem to work in more uncertain and dynamic environments (Iansiti and MacCormack, 1997), instead it is necessary to incorporate change as late as possible in the process (MacCormack *et al.*, 2001). This implies that project deliverable slack is necessary to incorporate late changes. If there is no slack in project deliverables then there is little or no possibility to make changes to the product.

Human competence as a category of organisational slack

A salient feature in the literature on firm-level categories of organisational slack is the importance of human resources, with organisational slack being seen as idle capacity or a surplus of employees (Nohria and Gulati, 1996; 1997). In the cases we studied, human resources were of course also important for knowledge creation. However, our observations indicated that it was not necessarily human resources in terms of the number of people that affected knowledge creation, but rather their collective competence, a distinction that has not been made in earlier literature. The following illustrates.

All four of the platform projects we studied had the same absolute number of members during the life of the project (or to be precise: the System project had a slight decrease in the number of members towards the end). However, looking at the competence in the project teams reveals another picture. As the projects evolved over time, but before the projects had reached an end, there was a tendency for experienced and competent people to be switched to other projects and be replaced by less experienced members. As a result, the projects were slowed down or halted

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[1]We follow MacCormack *et al.* (2001) who define uncertain environments as "follows: Environments in which future evolutions *in markets and/or technologies* are hard to predict. By dynamic, we [MacCormack *et al.*] mean environments in which these evolutions occur rapidly."

and the ability to experiment and be innovative were reduced, as efforts were needed to introduce the new members in the team. Our findings thus indicate that not only the absolute number of people involved in a project was important, but also their competence, to create knowledge. Hence, the following conclusion:

> *The level of the collective competence of project members is a category of organisational slack in product development projects.*

Human resource slack is thus a function of both the number of people and their respective competence. There is much human competence slack if there are (too) many highly competent members in the project team. If there are (too) few members who also have little competence, then there is little human competence slack. With this definition, the practice of replacing old and experienced project members with new and inexperienced project members reduces human competence slack. The consequence of reducing human competence slack is that the ability to create knowledge is hampered as efforts are directed towards introducing newcomers, instead of experimenting with new solutions.

Our findings are supported by Gupta and Wilemon (1990), who found that if there are too many inexperienced project members, or the wrong mix of members in a project group, the product development process is delayed. Our findings are also related to the influence of team tenure on process performance (Brown and Eisenhardt, 1995; Kessler and Chakrabarti, 1999). Project teams with short longevity lack an effective mechanism for sharing information and have not developed effective patterns for working together. This limits the amount and variety of information the project members are able to communicate. But on the other hand, if the teams have a long history together they tend to become inwardly focused, neglecting external communication (Levinthal and March, 1993). This is also known as the "not invented here" syndrome. The highest process performance is reached when the team tenure is at a moderate level. This is the result of new project members coming in with fresh ideas and approaches, challenging and improving the scope of existing technologies and methods (Eisenhardt and Tabrizi, 1995; Katz, 1982).

Influence of customer interaction on organisational slack

A recurring observation during our research was that the nature of the interaction with customers influenced organisational slack and the way in which knowledge was created in the product development projects. The more direct influence a customer had on the project, the less room there was to experiment within the project, which negatively affected knowledge creation. In the Processor project at Communication Supplier the initial freedom experienced by the project team was reduced as a customer was signed. The relationship with the customer was very close and resulted

in very strict specifications of what the product should look like and consist of. Although this did speed up the development process, project members had few possibilities to interact and experiment.

The Component project, the Integration project, and the Message project at Support Inc. were similar in the respect that initially they did not have a customer. The projects therefore experienced a freedom of working on the product without having to take into consideration demands from customers on delivering a specific product at a specific moment in time. This enabled members to engage in knowledge creation. As a customer was signed the demands to deliver a product increased and the projects experienced an increased pressure, giving them less opportunities to follow up probes and leads in directions other than that which were in the contract with the customer, hampering the knowledge creation in the projects. The Java project was different since it had a customer from the outset, which put pressure on the project from the start of the project. The project members claimed that they had little freedom to experiment with new things and only developed what was agreed on.

Our analysis of the cases thus revealed that as a customer was signed to a project, organisational slack was reduced. As a customer was signed, the result was less freedom for the project to experiment and follow up probes, which affected knowledge creation. The key to this reduction in slack was the interaction with the customer, and the customer's demands on, for instance, the final design of the product and deadlines. This finding leads us to the following conclusion:

> *The interaction between a project and its customers influences organisational slack in product development projects.*

Previous research has indicated that customer involvement is positive (von Hippel, 1986; Zirger and Maidique, 1990), particularly to speed up the development process. Brown and Eisenhardt (1995) argue that external communication with outsiders, such as customers, opens up the project team to new information. Two aspects speak in favour of involving the customer as a way of improving the productivity and pace of the development process. Firstly, if the information is task oriented, the members gain information and viewpoints from outside the team. Secondly, if the information is frequent, the members become more efficient in gaining and using the information they are given. In addition, it has also been argued that a development team should have a close contact with the lead customers (von Hippel, 1986). This ensures that the company understands what is the need of the user and these are translated into solutions for the customer (Zirger and Maidique, 1990). This seems to point in the direction of customer involvement being positively related to the productivity and pace of the development process. However, the point in time when a customer should be involved in the process is not exactly clear (Brown and Eisenhardt, 1997).

Our findings indicate that the effects of a close interaction with customers go beyond productivity and pace, and extend into knowledge creation. As a result of a customer being signed to a project, organisational slack is reduced, with subsequent effects on knowledge creation. A closer customer interaction implies that there is less room for knowledge creation since the members in the project have little time to interact and experiment. This may, however, be an advantage if a project needs to become more focused and reach a closure.

A conclusion from the discussion above could be that a company should not sign a customer as that seems to hamper knowledge creation within a project. That kind of conclusion is of course naïve, since a company always needs to have customers to sell their products. However, what is evident from the study is that the customer influences the knowledge creation in product development projects. Therefore, as is also suggested by Brown and Eisenhardt (1997), a company or a project should be careful about when to interact with a customer. Thus, the issue of timing, of when to sign a customer, is of crucial importance.

Influence of top management control on organisational slack

Top management had an important effect on the knowledge creation in the product development projects studied, through the control they exerted over the projects, or put another way, through the autonomy they granted to the projects. Four of the six projects, the exceptions being the System project and the Java project, exhibited similar patterns. Initially the projects were given freedom to set their own deadlines, both in terms of when to deliver different versions and what to deliver. Towards the end of the projects, however, top management took more control of the projects and emphasised that a final version of the product had to be delivered. This increased control corresponded highly with the entry of a customer. Thus, the autonomy initially given to the projects was reduced over time.

The Processor project can illustrate the observation on the changes in top management control. The project had initially no customer and as a consequence top management gave the project much autonomy. Then a customer was signed and top management pushed the project towards delivering a product to the customer, that is top management control had increased. However, as the customer cancelled the deal, top management lost interest in the project and the project team was once again given autonomy.

The System project and the Java project exhibit slightly different patterns with regards to changes in top management control, but without going against our observations. The System project had much autonomy from top management intervention all the time. The reason is that project Alpha did not find a customer and consequently top management did not exercise strong control over the System project.

The Java project, on the other hand, had little autonomy from top management from the beginning, as customers were present from the start of the project.

The significance of top management control, and particularly the changes in it, is that it had strong effects on how knowledge was created in the projects. As top management increased its control over a project there was an increased emphasis on the explicit knowledge in the project. The main reason being that top management could not use the tacit knowledge that the project had developed with regard to the product or concept being developed. This finding leads us to the following conclusion:

> *The control that top management exerts over a project influences organisational slack in product development projects.*

Taking this view, an increase in top management control means an increase in the control top management exercise over a project which reduces slack in the project. This is in line with earlier studies on firm-level organisational slack, which argue that as there is lax governance slack is increased and more autonomy is given, or conversely: increased control results in less slack (Cyert and March, 1963/1992; Nohria and Gulati, 1996). It is important here to note, however, that top management control is not to be confused with top management support, which has been positively correlated with product development success in several instances (for a review see Brown and Eisenhardt, 1995).

An increase in top management control is similar to a reduction of *subtle control* (Imai *et al.*, 1985). Subtle control means developing and communicating a clear product concept, which builds on a vision. Subtle control also incorporates the delegation of responsibility to project teams. As the subtle control is reduced, there is less freedom given to the project and the senior management does not delegate responsibility to the project. In addition the autonomy is also hampered, which reduces the motivation for the creation of new knowledge (Nonaka and Takeuchi, 1995). An increase in subtle control thus gives the team autonomy that in turn will make them motivated and creative, resulting in a better development process (Brown and Eisenhardt, 1995).

Our analysis suggests that top management needs to be careful in exercising control during the initial phases of an NPD project as that is the point in time where tacit knowledge is turned into explicit knowledge (Nonaka and Takeuchi, 1995; Nonaka *et al.*, 1994; von Krogh *et al.*, 2000). Our findings also helps to nuance the works of Simons (1994; 1995) who discusses the need of having informal control mechanisms; that is, making top management personally involved in NPD projects. However, Simons says little about how the role of top management control needs to be changed over time. Our analysis indicates that top management must be able to

interact with the NPD project throughout the project, but in different ways. Initially by granting autonomy (i.e. little control), while at latter stages increasing control.

Our findings on top management control as an influencing variable on organisational slack is in line with the findings of Bonner *et al.* (2002), who found that if top management goes beyond a directive role into a more detailed governance of a project it creates lower team performance. They therefore suggest that top management should be careful of how they intervene in project activities. Extensive involvement with many formal controls reduces the autonomy and consumes time for the product development team, but too little control can also be negative, as the team does not get guidance and feedback from top management (Karagozoglu and Brown, 1993).

Relationships between and the categories of slack and its influences

The relationships between the categories of slack and its influences are summarised in Fig. 3.

From the analysis it was possible to identify that as a customer was signed to a project, it was subjected to closer controls from top management; that is top management control increased. However, since the entry of a customer into a project in some instances was the result of the work by the top management, it is difficult to discriminate between the two influencing variables' top management control and customer interaction. Therefore the arrow in the figure is shown as a two-way arrow.

The entry of a customer and the simultaneous increased top management control had implications for project deliverables. Recall that project deliverables are made up of two parts: (i) when to deliver a product and (ii) what to deliver. Closer customer interaction and increased top management control influenced these two parts in different ways.

Closer customer interaction and the associated increase in top management control resulted in a focus on deadlines, and in the different projects it was of crucial importance not to miss the deadlines. However, contrary to what might be expected,
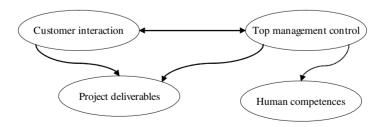

Fig. 3. Relationship between influencing variables on organisational slack and categories of slack at the level of the project.

a simultaneous emphasis on what to deliver did not occur. Instead it was actually possible for the projects to deliver only a part of what they had originally promised to deliver. The trade-off between schedule (i.e. when to deliver) and product specification (i.e. what to deliver) has also been found elsewhere (Karagozoglu and Brown, 1993).The explanation for the trade-off could be that the projects in the study all came from a highvelocity environment. In these environments, customer needs and technologies change fast (cf. MacCormack and Verganti, 2003), which means that it is necessary to have the ability to make changes to the product during a development project. As a consequence, it can be difficult to correctly anticipate from the beginning what the exact product should incorporate.

It was not possible to identify a direct relationship between human competence as a category of slack and the two influencing variables of customer interaction and top management control. One reason could be that project deliverables are to a greater degree related to the product being developed. It is something quite explicit that top management and customers. Human competence as a category of slack, on the other hand, is more difficult to grasp especially when it comes to the competence of members. However, needless to say, top management does of course have some influence as to which members can be signed to a project, which is indicated in Fig. 2 by the dotted line.

Conclusions and Directions for Future Research

The main conclusion of our findings is that it is inappropriate to think of organisational slack as a general concept. At the level of the product development project, different categories of slack exist. Our aim in the paper was to extend existing research and go beyond a focus of measuring slack at a firm level through annual reports, to identify how changes in slack influences the creation of knowledge in NPD projects. Taking into consideration the relationship between organisational slack, knowledge creation and innovation, we would on the basis of our results argue that it is not enough to think in terms of increases or decreases in organisational slack at a general level, to attain a certain outcome in innovation, as previous research has indicated. Instead, attention needs to be paid to the variables influencing organisational slack, the different categories of organisational slack in product development projects and their effect on innovation.

Through our exploratory case research, we redefined two different categories of organisational slack and identified two influencing variables at the level of the new product development project:

- *Project deliverables slack:* The possibility for projects to depart from the promised deliverables, in terms of deadline and/or product functionality, is a category of organisational slack in product development projects.

- *Human competence slack:* The level of the collective competence of project members is a category of organisational slack in product development projects.
- *Customer interaction slack:* The interaction between a project and its customers influences organisational slack in product development projects.
- *Top management control slack:* The control that top management exerts over a project influences organisational slack in product development projects.

Our findings also have implications for managers, although clearly more research is advisable before fully confident recommendations can be made to managers. The main implication from our research is that there are different categories of organisational slack and influencing variables in product development projects. Depending on the category of slack that is being reduced, we can expect different results on knowledge creation and ultimately innovation. In particular managers have to be aware of the role they play through the control they exercise over project and the influence customers have on the two categories of slack. Thus, the two influencing variables can be seen as levers that managers can use to affect how knowledge creation takes place in product development projects and thus ultimately innovation. The levers can be used to deliberately change the prerequisites of a product development project.

There are clear limitations to this research. More research is clearly needed to validate our findings. The limitations stem from several categories. We chose to conduct our research in the information technology and telecommunication industry. More research is needed to examine if the same influencing variables on slack and categories of slack can be found in industries with different characteristics. Another limitation is the sample size. Hence, opportunities for future research lie in these two directions:

(i) Replicating the study in different types of industries may help to identify further categories of organisational slack.
(ii) Doing survey-type research may help to validate the propositions derived in this research, through testing and clarifying our findings.

A further avenue which future research can take is to make a deeper investigation of the relationship between knowledge creation and the categories of organisational slack at the level of the product development project.

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