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ICOBI 2021

INTERNATIONAL CONFERENCE ON BUSINESS INNOVATION

REVITALIZING THE ECONOMY
THROUGH SUSTAINABLE STRATEGIES

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ICOBI 2021

INTERNATIONAL CONFERENCE ON BUSINESS INNOVATION

4TH INTERNATIONAL CONFERENCE ON BUSINESS INNOVATION

"REVITALIZING THE ECONOMY THROUGH SUSTAINABLE STRATEGIES"

FOCUSING

Social Sciences for Economic Revival

Contemporary Management for Sustainable Development

Innovative Sustainable Engineering for Economic Development

The Role of ICT in Reviving the Economy

Marketing and Tourism for Sustainable Development

Finance and Entrepreneurship for Economic Revival

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PREFACE

It is a great privilege for us to present the proceedings of ICOBI 2021 to the authors and delegates of the event. We hope that you will find it useful, exciting, and inspiring.

NSBM Green University is honored to present the International Conference on Business Innovation (ICOBI) 2021 for the fourth consecutive year. NSBM Green University, which turned a new page in the Sri Lankan Higher Education System by being the first of its kind in South Asia, successfully held the fourth International Conference on Business Innovation (ICOBI) in 2021 attracting wide recognition. With ICOBI 2021, NSBM takes a giant leap in the academic arena by creating a platform to bring together both local and foreign research conducted despite the Covid 19 pandemic. The theme of our fourth International Conference is "REVITALIZING THE ECONOMY THROUGH SUSTAINABLE STRATEGIES" which has attracted the attention of many academics, researchers, and strategists during recent times.

The pandemic and its accompanying economic challenges have been felt around the world. The recovery has begun, but to date, those efforts have produced asymmetrical results. Countries with high levels of social resilience and favorable economic conditions before the pandemic may fare better in the long term. While the full economic consequences of the Covid-19 pandemic will not be known for some time, there are pre-existing factors that may help countries along the path to recovery. Accordingly, ICOBI 2021 aims to provide a platform to discuss the issues, challenges, and opportunities that prevails to develop sustainable strategies by revitalizing the economy. This conference will explore what innovations, technologies, and partnerships are being leveraged to accelerate recovery at the local, national, and global levels, while also addressing what more can be done to ensure an equitable recovery. During the ensuing discussion, speakers stressed the importance of resilient recovery from the pandemic, focusing on the role that building productive capacities can play, along with long-term resilience to shocks. Papers and posters presented at the conference and included in the proceedings are intended to provide information.

It is our privilege to acknowledge the guidance and unwavering support extended by Prof. E. A. Weerasinghe, the Vice-Chancellor of NSBM Green University the visionary leader behind the success of this conference: and Deputy Vice-Chancellor, Prof. Chaminda Rathnayaka, for their support and guidance throughout the process. We are also grateful for the expert input and constant guidance of Prof. J. Baratha Dodankotuwa, the Head of Academic Development and Quality Assurance, without which the conference would not have been a success.

We would like to extend our gratitude to all the local and international presenters and participants for their contribution to the success of this conference. Finally, we are grateful to all the reviewers who helped us compile the conference proceedings and maintain the high quality of the manuscripts. ICOBI 2021 creates a platform for valuable academic contributions and intellectual discourses that will enhance the quality of higher education and eventually contribute to the development of the world tomorrow. The timely theme of the conference will also address the problems and issues of these unprecedented times and hopefully aid us in the process of finding solutions.

We wish all the attendees a productive and wonderful time at ICOBI 2021 organized by NSBM Green University, Sri Lanka. We will make sure to accommodate the presentations that were deterred due to the pandemic in the coming year. With your support and participation, the conference will strive towards success. Until then, we hope your experience with us remains fruitful and long-lasting.

The Conference Organizing Committee
ICOBI 2021

MESSAGE FROM VICE-CHANCELLOR

It is with immense pleasure that I convey my heartiest congratulations to the fourth consecutive International Conference on Business Innovation (ICOBI) 2021, at NSBM Green University Town, which has already acclaimed a historical milestone in our annual calendar after successfully concluding ICOBI 2020 last year. The primary objective of ICOBI is to address the requirements and demands of the country in fostering academic research and developments.

Through the fourth International Conference on Business Innovation, it is

envisaged to share and disseminate knowledge relevant to research and development under the theme of Revitalizing the Economy through Sustainable Strategies. With the onset of the Covid-19 pandemic, world economies have suffered greatly leading to a fear of an economic recession. The aim of ICOBI 2021 is to rejuvenate the declining economies through an academic discussion that encourages a sustainable and futuristic approach.

I believe this international conference will be of topical interest to academia, enabling a productive discourse. I congratulate the organizing committee for attracting a wide range of papers from experts in their fields and wish all the presenters and delegates a most informative and enjoyable conference.

Thank You.

Prof. E. A. Weerasinghe

MESSAGE FROM DEPUTY VICE-CHANCELLOR

It is with great pleasure that I extend a warm welcome to ICOBI 2021, the fourth International Conference on Business Innovation at NSBM Green University Town. I believe that this international conference provides a platform to bring together academics, researchers, and postgraduate students. ICOBI 2021 will embark on a whole new process of making discoveries while contributing to the existing discourse on Revitalizing the Economy through Sustainable Strategies.

NSBM Green University Town, as a pioneer in providing quality education, prepares graduates to meet the challenges of future industries. New knowledge and discoveries cannot be generated without any research and development activities; therefore, ICOBI 2021 operates as a generator of new knowledge that extends the research outcomes from experiments to practice, bringing about a tremendous impact on the future development of the country.

Whilst congratulating all the presenters, I look forward to an exciting day full of insightful presentations, intense dialogue, and fostering of collegial relationships. Most of all, I thank you, the participants, for enriching our annual conference with your presence.

Thank You.

Prof. Chaminda Rathnayaka

MESSAGE FROM
THE HEAD OF ACADEMIC DEVELOPMENT
AND QUALITY ASSURANCE

It is with utmost pleasure and pride that I welcome all to the International Conference on Business Innovation (ICOBI) at NSBM Green University Town. Last year, we witnessed a successful completion of ICOBI 2020 leaving behind a discourse worth continuing in the future as well. I sincerely hope ICOBI 2021 will have a bigger impact as it creates a platform for both academics and researchers to engage in a critical discussion.

We, here at NSBM, believe research and development form the backbone of our curriculum. The staff and students are engaged in various path-breaking innovative research activities throughout the year gaining new knowledge in various disciplines while contributing to the existing knowledge. ICOBI is the pinnacle of these attempts which brings researchers, both local and foreign, together to create discourses on vital contemporary subjects that require attention.

The 21st century confronts humanity with big challenges. Of these challenges, the spread of the global pandemic has proven to be the greatest hurdle in recent times. NSBM as South Asia's first Green University Town, as a frontrunner in sustainable development and green living, is assuming the task and the obligation of re-energizing the declining economies through sustainable strategies to create a future worth living both for us and for future generations. With this mission in mind, ICOBI 2021 is organized with the theme of Revitalizing the Economy through Sustainable Strategies, hoping to bring the attention of both local and international participants to an imperative discourse in contemporary society.

I congratulate the organizing committee for their hard work in making this event a success. Whilst congratulating all the participants, I wish them a very fruitful and rewarding conference.

Thank You.

Prof. J. Baratha Dodankotuwa

MESSAGE FROM THE CONFERENCE CHAIR

On behalf of the organizing committee, I am honored and delighted to welcome you to the 4th International Conference on Business Innovation (ICOBI) 2021 which is to be held at the NSBM Green University on the theme of "Revitalizing the Economy through Sustainable Strategies". With a record number of participants expected this year, we are delighted to see that this annual conference is becoming more substantial every year. I am equally excited about the record number of sessions, and the wide variety of ideas that scholars and practitioners will bring into our fold.

We're in the midst of an asymmetrical recovery. In some countries, Covid-19 infection rates have fallen significantly, while in others, the virus remains difficult to control. Whether governments are actively managing outbreaks or returning to normalcy, economic recovery is central to their forward-looking agenda. Without a broad-based economic expansion, it is difficult to address other prevailing challenges of any country. But how we create and shape the environment for economic recovery—and the opportunities and challenges in doing so—will depend on the strategies we implement. The post-Covid world will give us an unprecedented opportunity to create a stronger, and better version of our societies by recoupling economic growth and social progress. Accordingly, this conference provides some valuable insights to identify the opportunities to empower optimism as we come out of 2020 and face 2021 dedicated to creating our future through revitalising the economy. With a record number of attendees expected this year, I am hopeful that our annual conference will become much more impactful with each passing year.

Hopefully, the conference will enable researchers and participants to engage in a constructive dialogue aimed not only at achieving excellence in research, but also in managing the business. Some

of the most important themes in research and business innovation are covered in depth in our conference program, with keynote speakers, guest speakers, and session chairs highlighting them. I would like to express my heartfelt gratitude to them for their contributions to making our journey a successful one.

As Conference Chair, I believe that the success of such an achievement depends eventually on the work of many individuals around us, who were involved in planning and organizing the conference. I am truly amazed by the support given to us by the Vice-Chancellor, Prof. E. A Weerasingha, Deputy Vice-chancellor, Prof.Chaminda Rathnayaka, Head of Academic Development and Quality Assurance, Prof. Baratha Dodankotuwa, Dean – Faculty of Business, Ms. Thilini De Silva, Dean – Faculty of Computing, Dr. Rasika Ranaweera, and Dean – Faculty of Engineering, Dr. Chandana Perera, who have had a clear-cut vision to upgrade research and business innovation in our university.

I am thankful for the conference organizing committee members, the session chairs, the co-session chairs and the numerous volunteers, without whose generous contributions this conference would not have set another new record number of presentations and number of participants. A special note of appreciation should be extended to the academia for their thorough and timely reviewing of manuscripts on this special occasion.

Most of all, I thank you, the participants, for enriching these annual conferences with your presence. As is a tradition with ICOBI – I hope you will enjoy the content, renew old friendships, make new friends, get new ideas, and above all, have a good time.

Prof. Ganga Karunathilaka.

Conference Chair,

International Conference on Business Innovation 2021,

NSBM Green University.

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Designed By : **Mr. Ashika K. Witiwalarachchi**

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09.15 am - 09.25 am	Objective Statement of ICOBI by **Prof. J. Baratha Dodankotuwa** *Head, Academic Development & Quality Assurance,* *NSBM Green University*
09.25 am - 09.30 am	Introduction of Keynote Speaker by **Prof. Ganga Karunathilaka** *Conference Chair, ICOBI 2021*
09.30 am - 10.10 am	Keynote Address - Sri Lanka's Balance-of-Payments Crisis: Prognosis and Policy Options' **EmPr Premachandra** **Athukorala** *Professor of Economics,* *Arndt-Corden Department of Economics,* *Crawford School of Public Policy,* *Australian National University*
10.10 am - 10.35 am	**Research Presentation 01** Energizing The Economy Through Industry Advancement Mr. **Sumit Law** *Director, Wichy Plantation Company (Pvt) Ltd*
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01.00 pm onwards	Parallel Sessions

The Impact of University Education on Economic growth in Sri Lanka

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ABSTRACT

Universities are considered as one of the world's most powerful economic engines, and educational administration has become one of the fastest-growing industries in Sri Lanka. Universities require individuals to be economically productive, and as research and technology are important to economic growth, universities become their backbones. The major purpose of the study was to determine the contribution of universities and university students towards the social, cultural, and economic growth of Sri Lanka. This was a qualitative study to gather the representative's written and spoken opinions. It depicted how the universities contribute to the economy of Sri Lanka and its stakeholders, as well as the impact of university students on the social and cultural framework. The selected eighteen specialist experts, public organisations, and commercial enterprises that provide services to university students made as to the sample group. Semi-structured interviews were carried with representatives of public sector organisations, entrepreneurs, and economic groups. The researcher analysed and coded the data, establishing themes, organising and coding themes, describing and interpreting the outcomes. The outcomes demonstrated that social academics do not have a negative impact on the country's social perspectives. The contribution of university students to the economy was estimated to be approximately 28%. The current study found that universities helped the economic growth since their inception, notably in key areas such as transportation, markets, restaurants, lodging, hairdressers, communication, and tradesmen. Investments towards universities, according to the participants, were also important. Human resources were heavily reliant on education, and all educational expenditures were considered as investments, and it suggested that in-service training for qualification enhancement should be expanded.

Key Words - University, Economy, Education, Economic Development

1. INTRODUCTION

Educational management is one of the world's fastest-growing fields. Dagnew et al. (2020) said that the destiny of a state is inextricably linked to the education that successive generations acquire, particularly the education of young generations, who will determine the future. University is one of the most important economic elements. Universities are necessary for people to be educated in order to produce goods and services in a cost-effective manner. Because research and technology are generated in universities, universities are the backbones of economic progress (Demirel & Türkel, 2020). It is emphasised that building universities in large rural regions, particularly in poor and emerging nations, will assist the economy. Universities serve as the main institutions in the worldwide realm of science and information society. Education has a direct impact on a current societal degree of growth and economic development. This is why colleges play such an important role in society.

Although universities' primary goal is to guide human growth and intellectual life, their economic benefits cannot be overlooked (Ferreira & Oliveira, 2020). Universities provide a significant contribution to the economy when education is viewed as a sector. It is thought that there is a link between one's level of economic growth and the level of education they obtain. Educational economists highlight that the quality and degree of education received by individuals are the primary sources of development. Another advantage of education is that it has a significant impact on people's social, political, and economic structures, as well as their quality of life.

2. LITERATURE REVIEW

2.1. Education

Education is the process of providing people with information and skills, as well as assisting them in adjusting to society. To put it another way, education is the process through which people learn, develop their behaviours, physical and moral cognitive capabilities, creativity, problem-solving abilities, decision-making abilities, and the capacity to 2behavior them (Yehya, 2020). Education is a comprehensive process that involves changing people's attitudes and actions in order to help them become decent citizens with self-esteem and respect for others. Individuals must be educated on social and economic concerns throughout their lives (Georgiadis, 2007). It is a shift in human 2behavior brought by physical and cultural factors. Education is important economically because it describes how educational skills are applied in the manufacturing process.

2.2. Economy and Economic Development

In a broader sense, economics refers to the ability to fulfil infinite human demands with restricted resources. Home economics is where the word "economy" comes from. A country's industry contributes to service and commercial operations as a whole. Consumption of goods and services per person, literacy rate, number of individual investments and savings, quality of health services, productivity level per person, amount of energy consumed per person, individual education level, social life, attitude toward the environment; in short, the level of prosperity are the main factors determining economic development. In this regard, investments, employment, and the quality of education provided, as well as its impact on increased productivity, university student expenses, and overall human prosperity, all have a beneficial impact on economic growth (Kutlu, 2009). All countries' economic concerns have always been paramount. As a result, they develop short, medium, and long-term plans and implement them in specific programmes. Changes in a country's social, political, and cultural characteristics occur simultaneously with high output and revenue (Carnoy, 1995). Better living conditions, as well as the quality of products and services, are indicators of economic progress. As a result, economic success is a crucial step toward higher living standards. At this stage, it's critical that all people are living in the same economy share wealth and high living standards. Although economic success alleviates poverty, it should be viewed as a broad term that encompasses everything from equitable income distribution to the establishment of a social state.

2.3. Education Economy

The efficacy and productivity of human labour as a corporate input, as well as its contribution, are investigated in the education economy. The rationale is founded on the notion of human capital, which increases the productivity of labour and abilities (Carnoy, 1995). Individuals' degrees of quality education and the education they get have a well-proportioned relationship. The economic contribution of an individual is determined by their level of education. People's social, political, and cultural growth is influenced by the level of educational activity quality (Akmak, 2008). Education benefits the individual as well as the community. Education plays a key influence in economic progress and rising national GDP

(Vanichvatana, 2020). Mercantilism is the oldest school of thought that believes there is a link between economic events and a person's education (Joyami & Salmani, 2019). Human capital is a topic that many education economists focus on. The economic contributions of well-equipped persons with knowledge and skills are more appreciated as a result of increased industry and trade operations, and this encourages governments to think about education more than ever before. As a component in national income, mercantile placed a high value on human capital. Education is a priority for countries to survive and compete in today's global globe, owing to economic growth, increased human capital, and more creative and researcher manpower.

2.4. The purpose of the study

The purpose of this research was to identify the contributions of universities and university students to Sri Lanka's economic, social, and cultural growth.

3. RESEARCH METHODOLOGY

This is a qualitative study to gather the sector representative's written and spoken opinions. It looked at universities' contributions to the economy and stakeholders, as well as the impact of university students on social and cultural structures. Qualitative research is an approach that uses observations, interviews, and document analysis to uncover genuine and complete perceptions and occurrences in a natural setting. In qualitative research, experiences are discussed in great depth without fear of generalisation. In this study, a case study was used as one of the qualitative models. A case study investigates a situation in the actual world in the context of its current setting or surroundings. A case study is a method in which a researcher collects data from real life, a current system (an event), or many restricted systems (cases) using observations, interviews, audio-visual materials, documents, and reports, then organises it into themes and descriptions. A case study is a type of design that involves the product as well as the item. Detailed data is

gathered through observations, interviews, papers, and audio-visual material in such a study.

3.1. The Participants

Eighteen specialist sector experts, public organisations, and commercial enterprises that provide services to university students made up the study group. This study employed a "purposive sampling" strategy. This approach is used to look into instances where it is considered that rich data may be gathered. A code was issued to each participant. The coding process involves categorising textual or visual material into tiny groups.

3.2. Data Collection Instruments

Experts tested the interview form for reliability and validity ahead of time. The first component of the form consisted of questions aimed at eliciting demographic information from participants. The second portion consisted of twelve semi-structured questions. Semi-structured interview form and interview methods were utilised to obtain data. Observations, interviews, and reviewing written materials are the most common data collecting methods. To get thorough information on a subject, semi-structured interviews were performed. The questions were changed to be more understandable if the replies were not clear and intelligible. As a result, the information was gathered through semi-structured interviews. Opinion questions were used to elicit responses to particular queries about what a person thinks about a certain occurrence at a specific moment. Semi-structured interviews are used to obtain in-depth information about a topic. In the event of ambiguous replies, the questions are modified to provide greater clarification (Colak & Cetin, 2019). Seventy-three percent of the firms say they do production planning, but just a minority use professional management groups. When firms begin mass manufacturing, it is unavoidable that they contribute to the industry by overcoming financial difficulties and finding a means to expand their capacity.

3.3. Data Analysis and Interpretation

Because this was a qualitative study, a content analysis was conducted to aid in the data description. Studying and coding the data, creating themes, organising and coding themes, describing the results, and interpreting them are all steps in the content analysis process. When it came to describing, categorising, and interpreting data in codes and themes, the first stage was to take short notes while reading and remembering, followed by defining, classifying, and interpreting the data. The foundation of qualitative data analysis is the creation of codes and categories. The researchers can interpret the material based on their own perspectives and those of others. Codes like P. 1, P. 2, and P. 3 were used to designate the participants.

4. RESEARCH FINDINGS

4.1. Universities and University Students' Contribution to Economic Growth

Almost everyone in the group agreed that universities and the extra value they bring helped the economy in a variety of ways. Many industries benefit from foreign students' money, which has a beneficial impact on the economy and economic development, whether directly or indirectly.

4.2. The Economic Contribution of University Students and Their Population Ratio

The majority of participants believed that university students make up a considerable fraction of the country's population, with a thousand university students accounting for 1/3 of the population. They benefit a number of big and small companies that provide housing, food, transportation, and other services, all of which contribute considerably to the country's economy and growth.

4.3. Students' Impact on Social and Cultural Structure

The majority of the interviewees agreed that foreign students had no negative impact on the social and cultural framework. They, on the other hand, produced cultural diversity. Some participants voiced worry that, due to poor economic situations in their home countries, some international students may desire to stay and work in our country, severely impacting the social and cultural framework.

4.4. Subsidies from the government in the field of higher education

According to the findings of this study, more than half of the industry representatives believe that the state's commitment to higher education and student grants are insufficient. A tiny percentage of respondents believed that the government's contribution was sufficient. Similarly, a small proportion stated that they were unaware of the problem.

5. DISCUSSION

In research, Keskin (2011) emphasised the role of governments in economic development in order to enhance people's prosperity. Initiating the processes that underpin development is necessary for economic growth. One of these dynamics is technology, which leads to improved development results when employed in industrial processes. At this time, Keskin further emphasised that technical production could only be achieved through human capital, which is equivalent to social indicators in industrialised countries. Nations with high levels of affluence have higher levels of education, a longer average life expectancy, and a brain drain between countries. Human capital is thought to play a significant role in these shared traits. Human capital is heavily reliant on education, and all educational expenditures are considered investments. University education should be made available to a wider audience, capacity should be increased, and new universities should be established. Civil servant qualifications should be tailored to meet the needs of the public, in-service training should be provided to improve qualifications, and women should be included in the recruitment process. He came up with another conclusion in the same study, explaining that skilled people to fulfil the demands of economic growth should be raised

in order to form an investment quality and education to form a capital quality. This remark emphasises the importance of an individual's education and economic growth. These findings by Keskin are similar to those found in this study. Kingsley (2019), a school and facility management methodologist, explains the concept, nature, and forms of learning facilities, as well as the need for learning facilities. It was suggested, for example, that school administrators and instructors who often utilise learning facilities be given training on how to keep them in good working order. Salmani & Joyami(2019) said that the effect of students' trust in the university, the university's commitment to the student, the relationship between the university and the students, on perceived value, the perceived value of students' satisfaction, and the perceived value of students' loyalty were among the five hypotheses developed. Zürk et al. (2011) looked at how universities in Anatolia contribute to the region's socioeconomic and cultural systems. They said that the contributions made by these colleges determined the financial and socio-cultural structures of cities. They added to their arguments by stating that colleges should be created in cities with completely developed infrastructure in order to boost contributions and lead the people (Ztürk & Zkök, 2007). Dagnew, Yirdaw, & Asrat (2020) found that low-quality education, as well as deficiencies in the city's physical, socioeconomic, and sociocultural structure, will reduce universities' contribution to the city

6. CONCLUSION

6.1. Universities and University Students' Contribution to Economic Development

The study found that universities have helped considerably to economic development since their inception, notably in key areas such as transportation, markets, restaurants, lodging, hairdressers, and communication, as well as tradesmen. Almost all of the participants, including representatives from non-governmental groups and state-owned businesses, agreed that universities and students had a beneficial impact on the economy, tradespeople, and small and large businesses. Another element contributing to economic progress, according to the participants, is university investment and educated labour.

6.2. The Population Proportion of Universities and University Students and Their Impact on Economic Development

University students account for 1/3 of the population, which is regarded fairly high when compared to the overall population.

6.3. The Social and Cultural Effects of International University Students

When the number of students at universities is evaluated, it is clear that only a tiny percentage of students come from other countries. Despite this reality, there has been no detrimental influence on the island's social and cultural framework. They, on the other hand, generated a plethora of cultural diversity. However, these students' employment in a variety of occupations may have an impact on the social and cultural framework.

6.4. The State's Contribution to Higher Education

It has been noted that the state's support to universities and the subsidies offered to students are both relatively minimal.

7. SUGGESTIONS

Universities and university students provide a significant contribution to our country's economic growth and sectors. As a result, graduates and their job prospects must be constantly monitored.

To improve services to students and other customers and increase production, personnel in the sectors, whether graduates or not, should receive training through various programs in collaboration with the Ministry of Education, the Ministry of Labor and Social Security, the

private sector, and universities. Certificates should be provided to successful participants in these educational sessions.

The importance of educational economy and Human Capital Theory, as well as the role of educated individuals in the country's economic growth was highlighted in this study and other studies conducted in other nations. In this regard, all concerned sectors should examine long-term policies for the education sector's future. More resources should be provided for education and sector growth, and these plans and initiatives should become official policy.

Based on the conclusions, the government should concentrate on economic and sectoral growth within specified parameters.

To improve the existing situation and to increase student satisfaction, all student services should be reviewed in terms of satisfying the students' economic and qualitative demands. This issue is just as essential as the pupils' education. As a result, it should be thoroughly investigated.

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The Impact of Online Learning Facilities to the Effectiveness of Emergency Online Learning: A Case Study on NSBM Green University Town, Sri Lanka

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ABSTRACT

Students and their learnings are what makes a difference mostly in characterizing the fate of a nation. Accordingly, this research paper addressed how effective emergency online learning as a case study on NSBM green university town, Sri Lanka. With the expectation of noting the research problem, the effectiveness of Emergency online learning compared to the traditional in-class learning specially during coronavirus crisis was examined. Research took quantitative aspect by conducting survey and taking 1517 students as the sample using simple random sampling technique. Data were analyzed using a descriptive analysis and a statistical analysis and it was found that the impact of online facilities used to convey the online learning experience was way below the moderate level while the relationship between the online facilities provided and the online learning experience of students was also on a moderate level giving out a vague attitude on the preference for the online learning concept. Moreover, it was concluded that it was not a quite effective initiation during the COVID-19 pandemic and the obstacle on the continuation of academic related tasks as the pandemic forcefully shutdown several activities especially in the educational sector.

Keywords – Online Learning, Emergency Online Learning, Online Learning Facilities

1. INTRODUCTION

Since the outbreak of novel corona virus (Covid19), this pandemic acted as the host of drastic changes in how institutes including companies, schools and universities operate and deliver their services (Wyse et al., 2020). By the beginning of year 2020, this pandemic demands on immediate hold of in-person education in order to comply with health and safety regulations (Chen et al., 2020). Forced rapid shift from traditional physical learning to emergency learning was brought up to safeguard both educators and students from the contagious nature of Covid19 virus (Schultz & DeMers, 2020) Thus, this epidemic called for the forced change on operating digitally and utilization of digitally driven teaching and learning platforms for organizational continuity (Beaman & Davidson, 2020). This adoption of online solutions in recent months has been unprecedented. In the short term, educators are applying a 'first aid' solution by switching entirely from in-person to remote instruction, a move that has been forced upon them by sudden mandatory campus closures (Kandri, 2020). Educationalists, with new development of this pandemic are now realizing that "remote learning" is a kind of primary level of research in the complex process of offering online education which have student engagement tools and teacher training in to it (Kandri, 2020).

1.1. Problem Statement

Amidst the COVID – 19 pandemic, as a strategy to continue education to secure the flow of delivery, emergency online learning was carried out by most of the higher educational institutes in Sri Lanka. So far, e-learning has been effective to the people that understood its value. It offers the chance to have great results for lower costs and sometimes for no costs at all. Despite these, due to the global pandemic situation that is faced by the community, online learning has become a savior in these arduous times. Education may have several purposes, and online courses help to fulfill it. Hence, this study intends to examine the effectiveness of emergency online learning compared to the traditional in-class learning, especially during coronavirus crisis in light of the impact from online learning facilities utilized on the student's learning experience during the pandemic.

1.2. Research Question
What is the impact from online learning facilities on online learning experience?

1.3 Research Objective
To identify the impact from online learning facilities on online learning experience

2. LITERATURE REVIEW

Main purpose of this section is to discuss the above declared research question with the support of past literature. Key terms, theories and models presented by the preceding researchers, that would assist in finding answers for the research questions will be utilized.

2.1. Learning

Learning is a change in human disposition or capability that persists over a period of time and is not simply ascribable to processes of growth (Gagne & M, 1984). Leaning consists of basic concepts such as act, reflex, instinct, experience, behaviour, sense, perception, attention and memory (Akdeniz et al., 2016). Act reflects to the performance. What is done

by a person establish his or her performance. Reflex gives the meaning for the behaviours arises suddenly, in which those behaviours are inborn, quite immediate, and consistent and there should be a stimulus behind the action. Instinct implies an act that can be seen in all the members of a group that has been developed because of maturity not purely because of learning. Behaviours are both implicit and explicit (Akdeniz et al., 2016).

2.2. Online Learning

Online learning can be referred as a "wholly" online learning which uses the technology medium or context with which it is used (Rohsenow & O'leary, 1978). Online learning is mainly provided in two ways—in synchronous and asynchronous environments (Jolliffe et al., 2012). The time lag attributes of asynchronous learning unlike synchronous learning in online platforms take the advantage of accessing materials anytime and anywhere, ability to reach a greater mass at the same time, and uniformity of content. Online learning along with face-to-face learning is successfully used in industry as well as academia with positive outcome (Panigrahi et al., 2018).

2.3. Emergency online learning

The adoption of online learning in a situation of emergency represents a need, but it has also stimulated experts, policymakers, citizens, teachers, and learners to search for new solutions. This is producing a shift from the concept of online learning to emergency remote teaching, which represents "a temporary shift of instructional delivery to an alternate delivery mode due to crisis circumstances"(Charles Hodges et al., 2020). Due to the COVID-19 pandemic, many students around the world had to transfer from face to-face instruction to an online learning environment in the middle of the semester. People have limited information processing capacity, and there is potential that combinations of learning modalities can result in-cognitive overload, impacting the ability to sufficiently learn new information (Patricia Aguilera-Hermida, 2020)

2.4. **Effectiveness of Emergency online learning**

During the school closures, existing inequalities connected to different socioeconomic situations have increased mainly due to the following reasons like lack of resources, including access to educational technologies and the Internet and lack of physical spaces to carry out home-based learning among families from poorer backgrounds, who lack the basic skills to support their children, especially regarding secondary education (Ferri et al., 2020). There is some evidence that school closures can produce significant losses in educational achievement, in particular for disadvantaged students (Eyles et al., 2020). In the developed countries even, these factors have resulted in a large gap in how children have been learning during this emergency period (Bol, 2020). In developing countries, in which the majority of students do not have access to the Internet and adequate learning environments, such discrepancies are even more apparent (Owusu-Fordjour et al., 2020). Provision of more adequate e-learning platforms to increase access to the Internet and develop an interactive learning approach is suggested by many of the authors (Ferri et al., 2020)

3. **METHODOLOGY**

The approach of this study is quantitative approach while the type of study be analytical. The population of the research was considered as the entire student population in NSBM Green University Town. To deep dive into the study, research problems were discussed with technical aspect as well as with a comparison to the physical delivery of lectures by taking 1517 students representing all the three faculties in the university. Simple Random Sample was used as the sampling technique.

Data collection was done through a structed online questionnaire, containing 27 questions in which 26 are close ended and with only one question open ended to gain insight thoughts of the students. Data were analyzed using Statistical Package for Social Sciences (SPSS)

by undertaking a descriptive analysis and statistical analysis to come up with comprehensive analysis. Below Hypothesis was developed to achieve the objectives of the study.

H_0: There is no impact from online learning facilities on online learning experience.

H_1 : There is an impact from online learning facilities on online learning experience.

Finally, prior to this research, approval was obtained from the management of National School of Business Management to collect data from the undergraduates. Upon the approval, the name of the institute was used as NSBM Green University in the research paper. No participant was forced to participate for the study and voluntary participation were appreciated while ensuring academic integrity during the documentation process.

3.1. **Operationalization**

Table 1-Operationalization

Variable	Indicators
Online Learning Facilities (OLF)	What is the internet connection you use for online learning (OLF1)
	How do you connect to online lectures (OLF2)
	Rate the internet signal strength during online lectures (OLF3)
	What was the platform used for online teaching (OLF4)
	Do you use 'Chat Option' to communicate with your lecturer (OLF5)
Online Learning Experience (OLE)	I experienced high video quality in online lectures (OLE1)
	I experienced high audio quality in online lectures (OLE2)
	Lecture materials were clearly visible (OLE3)

| | I can easily communicate with the lecturer through online platforms (OLE4) |
| | Online learning is a comfortable learning method for me (OLE5) |

4. ANALYSIS AND DISCUSSION

4.1. Reliability and Validity Analysis

4.1.1. Reliability

Table 2-Reliability

	Reliability Statistics
	Cronbach's Alpha
Overall	.850
OLF	.705
OLE	.834

Considering the overall reliability derived, the Cronbach's Alpha is at a level of 0.850 which is on a very satisfactory, acceptable level that the collected data using the questionnaire is of high reliability since it is above the threshold value of 0.7.

When considering the reliability value of the Online Facilities, the Cronbach's Alpha is at a level of 0.705 which is on a satisfactory, acceptable level that the collected data using the questionnaire is of high reliability since it is above the threshold value of 0.7.

The reliability value of the Online Learning Experiences, its Cronbach's Alpha is at a level of 0.834 which is on a very satisfactory, acceptable level that the collected data using the questionnaire is of high reliability since it is above the threshold value of 0.7.

4.1.2. Validity

Table 3-Validity

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.902
Bartlett's Test of Sphericity	Approx. Chi-Square	7353.500
	df	45
	Sig.	.000

Furthermore, as per the KMO and Bartlett's test, the value 0902 indicates that the data collected for the study is suitable for structural detection and useful.

4.2. Descriptive Analysis

Table 4-Descriptive Analysis 1

Descriptive Statistics			
	N	Mean	Std. Deviation
MEAN_OLF	1517	3.3418	.69156
Valid N (listwise)	1517		

Considering the overall mean value of the online learning facilities, the independent variable, it is at a 3.34, which means a moderate level, that students are quite not satisfied with the online learning facilities, considering the minimum value being 1 and the maximum value being 4 according to the OLF scale items.

Table 5-Descriptive Analysis 2

Descriptive Statistics			
	N	Mean	Std. Deviation
MEAN_OLE	1517	3.4022	.62555
Valid N (listwise)	1517		

Also, when considering the overall mean value of the dependent variable, the online learning experience, it is at a moderate level considering the minimum value being 1 and the maximum value being 4. Therefore, it too denotes that the students stand on a vague attitude regarding the satisfaction level of online experience and preference towards it.

4.3. Correlation Analysis

Table 6-Correlation

Correlations		MEAN_OLF	MEAN_OLE
MEAN_OLF	Pearson Correlation	1	.604**
	Sig. (2-tailed)		.000
	N	1517	1517
MEAN_OLE	Pearson Correlation	.604**	1
	Sig. (2-tailed)	.000	
	N	1517	1517

According to the correlation analysis conducted as per the above table, the correlation value between the Online Learning Facilities and the Online Learning Experiences falls onto a value of 0.604. Which denotes that, the relationship between these two variables (independent and dependent respectively) are having a positive moderate relationship at a 0.604. When considering the Sig. (2-tailed) value being at 0.000, it denotes that the relationship between Online Learning Facilities and Online Learning Experiences is a significant level as it is below the 0.05 significant level threshold. Furthermore, it denotes that no matter where the level of online learning facilities is, the average amount of students in the considered sample have not experienced a satisfactory level of online experience.

4.4. Regression Analysis

Table 7-Regression Analysis

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.759^a	.576	.574	.38835
a. Predictors: (Constant), MEAN_OLF				

As per the regression analysis conducted, the R-Square value is at 0.576 which means online learning experience, the dependent variable of the students is explained by 57.6% by the independent variable, online learning facilities at a moderate level.

4.5. Hypothesis Testing

Table 8-Hypothesis Testing 1

ANOVA					
Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	40.531	1	40.531	268.740	.000
Residual	29.862	198	.151		
Total	70.393	199			

Dependent Variable: MEAN_OLE

As per the above ANOVA statistic, it indicates that there is a significant relationship existing between dependent and independent variables since the p-value is lesser than the 0.05 threshold.

Table 9-Hypothesis Testing 2

Coefficients					
	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
Model	B	Std. Error	Beta		
1 (Constant)	1.333	.135		9.848	.000
MEAN_OLF	.642	.039	.759	16.393	.000

Furthermore, as per the above coefficients table, since the *p*-value of 0.000 is lesser than the 0.05 threshold, it denotes that there is a significant effect from online learning facilities on the online learning experience. Hence, the linear regression model can be developed as below based on the multiple regression result.

Online Learning Experience = 1.333 + 0.642 Online Learning Facilities

It defines that there is a 0.642 moderate impact from online learning facilities on the online learning experience when online learning experience changes by one unit.

5. DISCUSSION

According to Ferri et al (2020), rise of the COVID-19 epidemic required institutes to move for online learning in an unexpected rapid way. Same does happen with NSBM Green University, where emergency online teaching and learning was adopted to have the smooth flow of academic activities of the undergraduates.

According to the analysis carried out, it was evident that the impact of online facilities used to convey the online learning experience was below the moderate level. Owusu-Fordjour et al., 2020 also argued that in developing countries, in which the majority of students do not have access to the Internet and adequate learning environments, such discrepancies are even more apparent. The technological challenges are mainly related to the unreliability of Internet connections and many students' lack of necessary electronic devices (Ferri et al., 2020).

The relationship between the online facilities provided and the online learning experience of students was also proven to be at a positive moderate level during the study on Effectiveness of Emergency Online Learning: A Case Study on NSBM Green University Town, Sri Lanka. It was also concluded that academic decline will likely occur but may be tempered by the increased use of practice tools

and may impact grades and schools differently (Wyse et al., 2020).

6. CONCLUSION

As per the research study conducted on the impact of online facilities provided at the university to convey the online learning experience, considering the necessity of conducting online lectures due to the COVID-19 pandemic situation and in order to retain smooth continuation of academic activities at the university, the impact has not been on a satisfactory level where according to the analysis, it clearly denotes that the impact was way below the moderate level while the relationship between the online facilities provided and the online learning experience of students was also on a moderate level giving out a vague attitude on the preference for the online learning concept. And also, there could have been more other factors involved due to such low-moderate impact such as; students not being able to engage in other student development activities like clubs and societies, students missing the university life, having less ability to make further clarifications especially related to analytical scenarios occurring during module lectures, physical and mental straining due to continuous hours of lecturing via the online platform (i.e. eye straining, muscle pains in the back and shoulders, other related ergonomic issues) etc. Also, as per the study, considering the overall mean values of online facilities and the learning experience, even though online lecturing would help to retain the continuity of academic work at the university, the effectiveness of this methodology of online teaching and learning, in the case of the NSBM Green University, we can conclude that it was not a quite effective initiation amidst this pandemic situation and the obstacle on the continuation of academic related tasks. Moreover, even though this method could be a success in foreign countries hence the students are more exposed to the online learning facilities and experiences according to previous studies brought in as literature to this study, but considering the Sri Lankan context and in the case of NSBM Green University, this online teaching and

learning practice has not been a successful one when especially considering the online learning experience experienced by the students who is the main target audience of this study

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Rising Amidst Chaos: A Critical Review on Resilient Leadership in the Sri Lankan Apparel Industry during Covid-19

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ABSTRACT

The complex and fluctuating business environment, especially crisis situations such as Covid-19 pandemic demands the leaders of the entities to be more agile and empathetic, giving prominence to the utilization of a resilient style of leadership. Though the epidemic created difficulties and resulted some entities to fail, some organizations who were more flexible and adaptive successfully catapult to a recovery stage, showcasing the exemplary leadership in the entities. Thus, this study intends to understand the paradigm of resilient leadership that facilitated the organizations to thrive despite such catastrophically intense periods and the factors that influenced the emergence of such an effective style of leadership in the Sri Lankan apparel sector during the pandemic by conducting a critical review of literature with the utilization of research papers published from the year 2012 onwards. The findings of the study provides valuable insights on the new paradigm of leadership; resilient leadership and the paramount factors that impact resilient leadership in the Sri Lankan apparel industry such as personal characteristics and crisis situations. Based on the literature review, it can be realized that an individual's personal characteristics such as empathy, communication skills, agility, hardiness, perseverance and the prevailing crisis situations in the dynamic business environment demands and fabricates resilient leadership in entities.

Keywords- Resilient Leadership, Apparel industry, Covid-19, Sri Lanka

1. INTRODUCTION

The volatile, uncertain, complex and ambiguous environment creates adverse events and crisis situations for companies, despite of their industry or the size, ultimately challenging the sustainability of the organization within the industry (Williams et al., 2017). Such situations has a vast impact on the leaders and members of an entity and the response of leaders to that situation has a direct impact on the effectiveness of the entity. Simply, the performance and outcomes of the entity would be predetermined by the characteristics of the individuals engaged in the administration (Antonieta et al., 2013).

Yet, it was identified that despite having such leadership in entities, the Covid-19 outbreak has created catastrophes in organizations of different sectors including the apparel sector, which is the largest source of export income in Sri Lanka (Bohingamuwa & Harishchandra, 2020; Portuguez Castro & Gómez Zermeño, 2020). According to Senaratne D. (2020), Covid-19 has a major impact on the apparel industry in Sri Lanka with the diagnosis of a Covid-positive factory employee in Minuwangoda. Further, the pandemic had a toll on the raw materials imported from China, a prominent supplier of raw materials in the Sri Lanka's Apparel Industry (Senaratne, 2020). Also, it was reported that the

apparel exports in Sri Lanka faced a loss of 1.5 billion USD (Sukumaran, 2020).

But, according to Tuly Cooray, the secretary general of Sri Lanka's Joint Apparel Association Forum, production facilities of Sri Lanka has the potential of functioning up to 50% of their prevailing strength (Senaratne, 2020). And it was identified that the pandemic outbreak presented some opportunities for the Sri Lankan apparel sector, which were successfully exploited by the administration of the organizations, ultimately helping them survive the tragic situation (Mirza, 2021). Few apparel organizations executed strategies like altering the business models, developing own brands, engaging in subcontracting in order to mitigate the adverse impact by the pandemic, showcasing effective leadership (Bolonne, 2020), while some apparel entities failed to function effectively despite having good leadership (Mirza, 2021).

The leaders of the organizations who thrived through the pandemic demonstrated an adaptive and flexible nature to the forces of the business environment, allowing them to achieve normalcy during calamities (Dartey-baah, 2015). This new paradigm of leadership is recognized as resilient leadership and in this highly dynamic environment, researchers have identified that it is the most appropriate leadership approach to be undertaken as it focuses on attaining the organizational goals and managing the changes within the organization so as to adapt to the fluctuations in the business world (Dartey-baah, 2015). According to the current literature, resilient leadership is the most ideal leadership style to be adopted by the leaders in the global economy today. With the Covid-19 outbreak that has affected a vast economy, despite of the industry (Portuguez Castro & Gómez Zermeño, 2020), resilient leadership is in demand so as to tolerate, survive and achieve normalcy during crisis times (Dartey-baah, 2015). Resilient leadership is a new paradigm of leadership that allows organizations to survive and sustain crisis situations as resilient leaders have higher adaptiveness to tough situations, have a sense of coherence and uses their personal traits and resources at its optimum level to combat crisis (Dba & Cha, 2021).

Hence, this study intends to explore the main factors that impact resilient leadership in the apparel sector of Sri Lanka during pandemic period.

2. RESEARCH METHODOLOGY

The present study is conducted in order to explore the factors that impact resilient leadership in the apparel sector of Sri Lanka which was immensely affected by the Covid-19 pandemic. Even though as per the reports, the Covid-19 pandemic has impacted the Sri Lankan apparel sector in the early 2020's, the concept of resilient leadership had long been studied in the past few decades. Thus, the critical review of literature is conducted by utilizing research papers published in reputed journals from 2012 onwards. The outcome of the conducted empirical survey illuminates on the extant body of literature on resilient leadership and the factors that impact resilient leadership during the Covid-19 pandemic.

3. IMPACT OF PANDEMIC TO THE SRI LANKAN APPAREL INDUSTRY

A study conducted has stated that sustainability of an organization would be challenged by the dynamic business environment despite of the industry and the size of the organization (Williams et al., 2017). For instance, the outbreak of the pandemic has created calamities in the corporate setting, hence making it a need for the administration to respond to such crisis situations in order to survive and sustain in the industry (Antonieta et al., 2013). The pandemic had unprecedented adverse impacts on different sectors of the Sri Lankan economy that includes the apparel, construction, tourism and banking and finance sectors (Bohingamuwa & Harishchandra, 2020).

The apparel sector of Sri Lanka is an industry that has direct employments over 300,000 and a sector that has reported an export value of $5.6 billion in the previous year (Kavindi et al., 2021). But, as stated by Senarathne D. (2020), the apparel sector of Sri Lanka was immensely affected by the Covid-19 pandemic outbreak.

The apparel sector of Sri Lanka is the largest export income generator, and it had an adverse impact from the pandemic outbreak with a loss of approximately 1.5 billion USD in exports (Bolonne, 2020).

Further, concerns that arose with the extended curfew and lockdown period such as the mass cancellations of orders that was already manufactured and are in the process of being manufactured, discounts that was forced and supply chain issues made the apparel industry of Sri Lanka to shrink (Bolonne, 2020). Most of the apparel companies that is located in Sri Lanka obtains the necessary raw materials from China, which is the origin country of the Covid-19 pandemic. With the imposition of the lockdown, the supply of the necessary raw materials was disrupted, and it had a significant impact on the Sri Lankan apparel industry (Kavindi et al., 2021). Further, cargo handling was delayed due to the limitations imposed on foreign flights and the vessels were also stationed for quarantine in the ports for a period of time, making transportation across countries a difficulty. Restrictions imposed domestically created difficulties in the domestic supply chain, ultimately widening the gap in between the demand and supply of apparels (Kavindi et al., 2021).

Moreover, the unprecedented impact on the apparel industry of Sri Lanka created havoc and organizations faced challenges in terms of costs that includes manufacturing and operational costs. The inability of Sri Lankan manufacturers to import the necessary raw materials from China led the Sri Lankan apparel manufacturers to search for local material suppliers, where the raw materials were more expensive than that of the imported raw materials from China, leading to the increment of manufacturing costs. Also, the reduced demand for the apparel products made the customers to place orders that are small in size further leading towards increased manufacturing costs (Kavindi et al., 2021). During the pandemic period the customers led to cancel the orders that was placed and sometimes was already manufactured, leading the organization to incur an inventory holding cost,

ultimately escalating the operational costs of the apparel manufacturers of Sri Lanka (Kavindi et al., 2021).

Also in terms of the management of the workforce, the entities had to reduce the benefits, cut salaries, reduce the overtime hours, engage in roster based working, implement health policies and provide safety equipments and the necessary training to the employees (Kavindi et al., 2021).

Furthermore, the apparel entities in Sri Lanka faced product shifts where they had to manufacture safety clothing including face masks, antiviral clothing which is a completely novel experience and a platform for novel innovations (Kavindi et al., 2021). For an instance, the Hirdaramani Group has partnered with the Sri Lanka Institute of Nanotechnology and CirQ technology in order to create the BreathTech-S3 Mask, which can be identified as a face mask that is designed in a sustainable manner (Wright, 2021). Moreover, the pandemic situation resulted the large scale apparel entities to engage in online sales and e-commerce practices at a different level than they used to be (Kavindi et al., 2021).

4. RESILIENT LEADERSHIP STYLE

Leadership can be recognized as a complicated process that involves various dimensions and an idea that had the attention of a large number of scholars around the world. It is identified that different scholars have defined leadership in different ways and each of the definitions and findings about leadership has evolved over time (Northouse, 2013). Even though leadership has been conceptualized in variety of ways by different scholars it can be identified as a process that attempts to influence another person or else a group of people in order to achieve a stated common goal (Northouse, 2013).

In order to attain the productivity and the effectiveness of an organization it is vital that the leader of the entity adopts the most effective and the most appropriate style of leadership (Nanjuundeswaraswamy & Swamy, 2014). Different scholars have studied about different styles of leadership including transformational,

transactional, servant, authentic and team leadership styles that was adopted by leaders in the attempt of facing the changing and highly complex corporate environment (Northouse, 2013).

4.1. Definition

In an array of different leadership styles, a new paradigm of leadership, "Resilient Leadership" emerged with these crisis situations, where the resilient leaders understood the urge of being adaptive to the highly dynamic business environment (Dartey-baah, 2015). Even though a clear and precise definition is not derived, different scholars have phrased resilient leadership in different ways (Table 01).

Resilience can be recognized as the capacity of individuals to face adverse situations, traumatic situations and encounter such situations by recovering from such calamities (Kohlrieser & Rossi, 2014). Simply, it is the ability of individuals to keep moving forward despite of the adverse, crisis situations or rather overwhelming odds (Sanaghan, 2016). It is identified that resilient leaders have the potential of working under pressure and also the ability to face radical changes in the dynamic environment.

Table 1-Resilient Leaders and Resilient Leadership Definitions

Sample Source	Definitions
(Dba & Cha, 2021)	Resilient Leadership is a new definition of leadership style that allows entities to survive in the uncertain business environment while sustaining the mission of the organization. Resilient Leadership is identified as a process of preparing individuals, practices and systems to be flexible enough to adapt to uncertainties.
(Khanna, 2021)	Resilient Leadership allows individuals to manage the complex and uncertain changes in an entity while adapting and being flexible with the challenging situations by aligning the vision and the purpose , managing one's own self during uncertain and ambiguous times, building higher level of awareness and anticipation, encountering the challenges with perseverance and adopting a growth mindset.
(Renjen, 2020)	Resilient leadership is about encouraging and motivating the other individuals to utilize a very calm, logical and methodical way to deal with anything that might happen in the future. Resilient leaders are individuals who should be more empathetic and compassionate to other individuals during turbulent times.
(Wills & Nadkarny, 2020)	Resilient Leadership can be recognized as the leadership that fosters and allows complicated systems to operate and thrive during highly turbulent or rather crisis situations. Resilient leadership is a new paradigm of leadership that should be learned and flourished from situations of failure and uncertainties in the business environment. Resilient Leadership can be identified as a quality that should be possessed by a particular leader or rather an individual so that the person can cope with mishaps, face both physical and mental fatigue without shrinking while being matured emotionally.
(Joy, 2017)	Resilient leadership is a style of leadership where the leader would weight their efforts including time and also the energy on the situations and things that they can influence on rather than worrying about the uncontrollable, uncertain situations. Resilient Leaders are the individuals who has the ability of getting the optimum use of the available internal and external resources and responds to crisis situations with courage by having the potential to bounce back, by making hard decisions at the right time and by opening themselves to feedback Resilient leaders has the potential of introducing novel goals to their followers in order to work on and prove that the challenges are mere trials that has to be encountered.
(Sanaghan, 2016)	Resilient leadership is the leadership style that enables individuals to survive and lead under situations that are stressful, complex and ambiguous by adapting to the new normal situations.
(Ledesma, 2014)	Resilient leaders portray a sense of positive mindset, coherence, self-esteem, hardiness, self-efficacy, perseverance and higher tolerance of ambiguity and failure.
(Kohlrieser & Rossi, 2014)	Resilient leaders are individuals who has the capacity of facing calamities, adversities, crisis and setbacks, and recover from such situations while supporting the team members to sustain their energy levels throughout.
(Zolli, 2013)	Resilient leadership can be identified as the potential of an individual to maintain and

sustain the core purpose and also the integrity in radically fluctuated situations.

Source: Author developed

According to Goh Yuang et al (2005), it is identified that the leadership style adopted by an individual would be immensely influenced by the family background of the respective individual. Apart from the family background it was identified that styles of leadership is affected by the socio demographic factors, personality traits, culture of the company, belief system, diversity of employees, organizational structure, experience, level of control on hand (Othman et al., 2012; Patel, 2018). Furthermore, a leaders' style of leadership is the relatively accordant behaviour of the person that specifies a leader. The utilization of various leadership styles by the leaders by properly understanding the dynamic business environment has a direct impact on the performance and the effectiveness of the entity, also contributing to the success or the failure of the entity (Nanjuundeswaraswamy & Swamy, 2014).

But the studies conducted on resilient leadership mainly highlights on different personal characteristics and the prevalence of crisis situations that would act as determinants of resilient leadership style

4.2. Crisis Situations

Current literature states that resilient leadership is an ideal style of leadership to be adopted during turbulent times as it allows to tolerate, survive, adapt and achieve normalcy during adversity (Dartey-baah, 2015; Portuguez Castro & Gómez Zermeño, 2020). According to Kohlrieser & Rossi (2014), resilient leaders can face and encounter traumatic situations without altering their behaviour or without causing harm to other individuals. It is identified that if leaders are unable to catapult forward during crisis situations, then it would lead the entity to fall back in the dynamic and competitive business environment, determining the effectiveness of the leadership adopted (Sanaghan, 2016).

In resilient leadership, it is vital that the leaders perceive the crisis situation as it is without denying the adversity of the calamity. Simply, the leaders are supposed to accept the reality as it is by being optimistic towards the crisis situation and by having the will to face the challenge despite the adverse outcomes (Sanaghan, 2016). Furthermore, resilient leadership is an attempt of enduring tough and crisis situations by having a clear understanding about the purpose and also the meaning beyond the challenges, which allows the leaders to act with courage and make hard decisions in encountering or rather mitigating the adversities (Sanaghan, 2016). Also, it is recognized that the individuals who adopt the resilient leadership style tend to be more intellectually curious, where they attempt to explore a wide array of possible solutions in order to face the crisis situations with the ultimate intention of achieving success in the organizational context (Sanaghan, 2016).

Accordingly, resilient leaders carries out particular actions and comes up with strategies to deal with crisis situations, mainly under three dimensions; Respond, Recover and Thrive (Renjen, 2020). In the stage of responding, resilient leaders are supposed to get themselves and their team prepared for continuity while in the stage of recovery, the leaders would get themselves enlightened and would tend to rise more stronger than they were. In the last dimension of thriving, resilient leaders would get themselves and their followers prepared for the next normal situation (Renjen, 2020). Thus, resilient leadership is about undertaking strategies and actions by the leaders in order to surpass these three stages during a crisis situation (Joy, 2017; Ledesma, 2014; Wills & Nadkarny, 2020).

According to Renjen P. (2020), organizations pass through three stages during crisis times, including the Covid-19 pandemic situation; Respond, Recover and Thrive; and resilient leaders must enhance their personal characteristics by adopting various steps in order to combat the crisis situation and support the entity to thrive with success by making the pandemic situation an opportunity to keep moving forward while creating more value to the stakeholders involved. Simply, the Covid-19 epidemic can be recognized as a crucible where the new paradigm of leadership; resilient leadership is polished (Renjen, 2020).

4.3. Personal Characteristics

The spread of the Covid-19 pandemic has affected the lives of individuals and also the economy in a massive scale, leading the leaders to ponder on how their entities would survive and thrive through this epidemic (Renjen, 2020). Most of the organizations executed different strategies to mitigate the aftermath of the Covid-19 situation and to transfer to a recovery stage (Bolonne, 2020).

In doing such the personality and the personal traits of the leader such as optimism, coherence, self-efficacy, effective communication, sense of unity, higher level of tolerance of failures and ambiguity, perseverance and agility will come into play. Accordingly, the leaders in the organizations had to be more empathetic and compassionate towards their employees and customers during this crisis time while finding ways and means to sustain the business in the complex and uncertain business environment, by putting both their head and heart into action (Renjen, 2020).

By being a resilient leader during this pandemic period, business leaders has the potential to strive and thrive towards their goal with the unshaken focus they place on the set goals and objectives by trying to seek and exploit opportunities despite the pandemic situation. Also, the leaders of organizations had to make tough decisions during this period even if their hands are on a pool of imperfect facts and information by being more courageous (Renjen, 2020). Moreover, the leaders in the contemporary context, where the world is adapting to the new normal had to be more transparent with their actions and the realities while trying to set foot for a future that is of best interest to everyone involved with the organization by being more long term oriented with novel innovations (Renjen, 2020).

5. CONCLUSION

Succinctly, it can be recognized that the highly dynamic business environment creates wreak havoc in the corporate setting despite of the industry and it is vital that the administration of the organization adopts the most ideal style of leadership in order to combat the crisis situation. Even though the entire economy was severely affected by the Covid-19 outbreak, it is recognized that certain industries are surviving and thriving through the epidemic with the strategies and actions undertaken by the administration as ideal leaders, which is different from that of the traditional leadership style they adopted prior to the pandemic outbreak. As per the conducted studies, it was affirmed that resilient leadership style, which is a new paradigm of leadership is highly appropriate during turbulent situations. Most of the studies conducted on resilient leadership states that it is influenced by determinants like personal characteristics and crisis situations, while other factors are loosely discussed. Thus, it creates a scarcity and the ground in order to explore more about the new paradigm of leadership; resilient leadership. Furthermore, the existing literature on the crisis situations and personal characteristics that impact resilient leadership is widely dispersed, and thus the author has undertaken the attempt to cumulate the essence of the prevailing literature. Lastly, it can be recommended that a resilient style of leadership can be used in different crisis situations and not limited to the Covid-19 pandemic outbreak.

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Green Virtual Learning Behaviour: Evidence from Postgraduates' Students in an Emerging Context

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ABSTRACT

As technology drives traditional learning activities to virtual spaces, it has quickly evolved into more sophisticated forms and influences. The use of virtual learning has become popular in distance learning and its use is rapidly increasing, especially in COVID 19 convergent situations. Green virtual learning is a crucial part of sustainable learning. Adoption of green information technology for virtual learning is an initiative of pro-environmental behaviour, and usage is limited in emerging contexts due to a lack of knowledge of its usage and outcomes. The purpose of this study is to examine the drivers that drive students to adopt green information technology practices into their learning processes. A theoretical model was developed for the study based on the Advance Theory of Planned Behaviour and existing literature. . A survey questionnaire was distributed by using the snowball sampling technique among selected postgraduate students who practice virtual learning in their studies. 123 responses were gathered, indicating an 84% response rate, and the data was analysed by using the SPSS 25 version. Results of the study revealed that the behavioural intention to use green information technology practices was significantly determined by students' attitudes, perceived behavioural control, personal norms, and ecological conscience. Study results provide insights to stakeholders on how students adopt green practices in their learning process and the variables that drive that, and study results are beneficial for making necessary arrangements to develop a sustainable learning culture among individuals in emerging contexts. The study findings' generalizability is limited to the higher education sector in an emerging context. Future studies encourage expanding the study to secondary and graduate educational levels to contribute to the development of a sustainable learning culture in emerging contexts.

Keywords - Behavioural intention, Ecological Conscience, Green Information Technology, Sustainable Learning, Theory of Planned Behaviour, Virtual Learning

1. INTRODUCTION AND PROBLEM IDENTIFICATION

Sustainable development is an arguable topic in the world, and there have been discussions about adopting more environmentally friendly practices. The higher rates of energy consumption have become a burden to businesses both economically and environmentally. Green Information Technology (Green IT) is a widely discussed topic among these practices as most organizations and individuals engage in IT activities daily (Melville, 2010). However, this concept; Green IT supports the environment by "improving energy efficiency, lowering greenhouse gas

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emissions, using less harmful materials, and encouraging reuse and recycling" (Murugesan & Gangadharan, 2012). With the rapid globalization of virtual learning, the usage of green technologies has increased. This is because it benefits organizations and individuals to be efficient with time, currency, and resources. Furthermore, this enables the promotion of virtual learning environments (VLEs). Green technologies in higher education can be used to reduce costs, improve efficiency, and reduce environmental impact while promoting VLEs (McWhorter et al., 2016). The outbreak of coronavirus disease (COVID-19) has heavily affected all aspects of life, including university education. Universities across the world have started to shift from traditional in-person classes to online classes. It has generated an opportunity to conduct experiments related to online learning in universities (Nature, 2020). Therefore, studying through virtual learning will be ideal in this pandemic situation.

Individual contributions and actions are crucial in determining the success of Green IT, yet there is a lack of studies related to individuals' beliefs and behaviours when adopting green IT (Chow & Chen, 2009). Further, prior studies have examined the factors affecting green IT adoption and utilization from an organizational perspective (Chen et al., 2011; Gholami et al., 2013; Molla & Abareshi, 2012; Molla et al., 2014). Therefore, it becomes more important to investigate the driving factors of adopting green information technology from the point of view of individuals. Thus, the current study was conducted for postgraduate students deviating from the organizational view. The Theory of Planned Behaviour (TPB) explains consumer behaviour and specifically, it addresses both behavioural intention and actual behaviour (predictive). Mostly, technology-powered education is based on TPB to understand the students' acceptance of virtual learning (Kim et al., 2021). In TPB, behavioural intentions are similar to real behaviour, and they are recognized by a person's attitudes, subjective norms, and perceived behavioural control (Venkatesh & Bala, 2012). This study aims to examine variables of TPB, and additionally, ecological

conscience has been added to the theoretical framework. With changing communication needs, there is a need for a new culture of sustainability, and such a culture should instil ecological conscience in the young, resulting in responsible consumption patterns and energy savings. . Further, environmental consciousness describes an individual's commitment towards the environment (Zimmer et al., 1994), and this behaviour is influenced by his consistent feelings towards environmental activities (Huang et al., 2014). According to Huang et al. (2014), this environmental consciousness positively affects, green consumer behaviour. Based on these facts the present study contributes to the existing literature by strengthening the current knowledge on the behavioural intention of green virtual learning by expanding the model of TPB by including ecological conscience.

2. LITERATURE REVIEW

Green virtual learning refers to a sort of learning that is conducted in the online environment based on information and communication technologies designed for delivering self-paced (asynchronous) or live web-conferencing (synchronous) methods in an environmentally friendly manner (Jessica, et al., 2021). Green virtual learning is an important component of sustainable learning, and the application of green information technology to virtual learning is a pro-environmental initiative (Constantin, et al., 2020).The theory of planned behaviour is a recent theory intended to describe various behaviours over which humans can exercise self-control. The theory of planned behaviour identifies three major constructs that lead individuals to specific behaviours (Jessica, et al., 2021). First, attitudes refer to the degree to which a person views the activity of interest favourably or unfavourably (Ajzen, 2011). Subjective norms are beliefs about whether most people agree or disapprove of a particular behaviour (Ajzen, 2011). Perceived behavioural control refers to how easy or difficult it is for an individual to complete a specific behaviour, highlighting previous experiences and potential future challenges (Ajzen, 2011). Ecological conscience relates to people's attitudes toward

environmental preservation and conservation, which motivates them to perform activities that support such efforts (Zhao, Gao, Wu, Wang, & Zhu, 2014). Based on the above variables, figure 1, a conceptual framework was developed for the current study.

2.1. Conceptualization
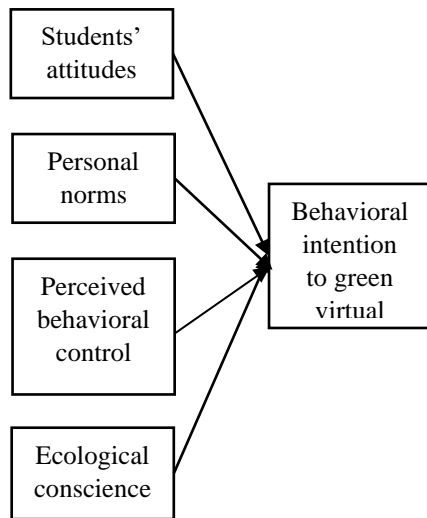
Figure 1- Conceptual framework
(Source: Authors constructed, 2021)

2.2. Hypothesis development

In previous literature on environmental attitudes (Kim & Lee, 2020; Rather & Hollebeek, 2021) Subjective norms (Han, Hsu & Sheu, 2020; Nguyen, Lobo & Nguyen, 2018), perceived behavioural control (Carfora, Caso, Sparks, & Conner, 2017; Lin & Niu, 2018), and ecological conscience (Mataracı & Kurtulu, 2020; Panda, Kumar, Jakhar, Luthra, Garza-Reyes, Kazancoglu, & Nayak, 2020) explained the positive association with the behavioural intention to adopt environmentally friendly practices in the working processes. Based on that prior literature evidence, the following hypotheses were developed:

H1: Students attitudes positively impact on behavioural intention of green virtual learning

H2: Personal norms positively impact on behavioural intention of green virtual learning

H3: Perceived behavioural control positively impacts the behavioural intention of green virtual learning

H4: Ecological conscience positively impacts the behavioural intention of green virtual learning

3. METHODOLOGY

This employed a descriptive research design that allowed assessing the associations between the variables described in the model. After reviewing the literature, four variables were identified and based on that conceptual framework, and four hypotheses were developed. Higher education institutes are progressively recognizing that they have a vital role to play regarding environmental issues. This is the reason universities are referred to as "change agents" that need to develop a curriculum to enhance students' knowledge and skills in sustainability (Mcmillin & Dyball, 2009). Further, Arnon, Orion & Carmi (2014) indicated that the dynamic business world has a responsibility to educate students on environmental issues and sustainability, and higher education institutions play a key role in cultivating the environmental literacy of graduates.

Therefore, this study focuses on investigating the green virtual learning behaviours of postgraduate students in Sri Lanka from an individual perspective. Hence, the unit of analysis was the individual. According to the Sri Lankan University Grant Commission UGC, (2020) data, more than 40,000 students enrol in state universities in Sri Lanka to read postgraduate courses, and based on that, postgraduate students were selected to collect primary data, Therefore, the theoretical population of this study is postgraduate students in state universities in Sri Lanka. Due to the practical limitations and complexities of reading students for the Master of Business Administration at a reputed state university located in the Western province, Sri Lanka was selected as the study population. A Google form survey questionnaire was distributed by using the snowball sampling technique among selected postgraduate students who are practicing virtual learning in their higher studies. A total of 123 responses were gathered,

indicating an 84% response rate. The constructs of the research model were measured using previously validated instruments. All the constructs used a five-point Likert scale where respondents marked their agreement, ranging from strongly disagree (1) to strongly agree (5). Gathered data is analysed using the SPSS 25 version.

4. ANALYSIS

Responses gathered from 123 postgraduate students at a reputed state university in Sri Lanka were used to analyse this study. Sample compositions of the study are represented in table 1.

Table 1-Sample composition

Variable	Category	Frequency	Percentage (%)
Age group	20-25	27	22
	25-30	53	43
	35-40	19	15
	More than 40	24	20
Gender	Male	56	46
	Female	67	54
Number of semesters learning by using from virtual platforms	1 semester	12	10
	2 semesters	39	32
	3 semesters	61	49
	4 semesters	8	7
	More than 4 semesters	3	2

(Source: Survey Data, 2021)

First, check the normality of the Shapiro Wilk test and data set. The results indicate that the data set is normally distributed. The reliability of the constructs was measured using Cronbach alpha values and the threshold level was considered to be 0.6 (Bagozzi & Yi, 1988). The highest reliability value was indicated (0.952) by

students' attitudes, while the lowest reliability value was reported by personal norms (0.812). As all constructs meet the threshold value, there are no concerns about low internal consistency among the constructs. The hypothesis was tested using multiple regression analysis. According to the multicollinearity analysis results, the results indicated statistically acceptable tolerance and VIF values. The Adjusted R Square value of the model summary results indicated a .721 value. Thus, the regression model explains 72% of the variance in the green virtual learning behaviour among postgraduate students specified with four independent variables in the research model, and the ANOVA test confirmed that the regression model is statistically significant (F = 74.544, P= 0.000).

. Table 2-Regression results

| | Unstandardized Coefficients | | | |
	B	Std. Error	t	Sig.
Students' attitudes	.439	.080	4.871	.003
Personal norms	.231	.061	3.691	.000
Perceived behavioural control	.897	.169	5.372	.000
Ecological conscience	.366	.134	3.569	.002
Adjusted R Square	.721			
ANOVA	F = 74.544, (P= 0.010)			

(Source: Survey Data, 2021)

Based on table two observed data derived H1, H2, H3, and H4 hypotheses were accepted. In sum, this study confirms the results of the TBP data.

5. DISCUSSION OF FINDINGS AND IMPLICATIONS

The study revealed that students' attitudes, personal norms, and perceived behavioural control positively impact the behavioural intention of green virtual learning, aligning with the previous research studies (Kim & Lee, 2020, Han, et al., 2019, Carfora et al., 2017, Panda et al., 2020). Further ecological conscience was incorporated into the model of TBP to expand the knowledge. Study findings depicted ecological conscience has a positive impact on green virtual learning. Thus, the extended TPB model satisfactorily demonstrates the positive relationship with the behavioural intention of green virtual learning. Hypothesis 1 illustrates that attitudes positively impact the green virtual learning behaviour of postgraduate students. Universities should promote programs to develop more favourable attitudes towards virtual green learning. They can encourage students to use LMS by improving the quality and including Wi-Fi zones for their use. Also, online mentor systems, online lectures, and online examinations can be arranged so that many students can participate, reducing parking and traveling. Applying these virtual learning methods saves a lot of energy, power, heating, and cooling compared to physical learning. A study has investigated that virtual learning requires 90% less energy than traditional physical classroom learning, and CO_2 emissions per student are reduced by 85% (Badgett, 2014). This will be energy-saving due to fewer driving emissions, less use of paperwork, and the ability to learn at home.

Next, subjective norms impact the behavioural intention of green virtual learning, and universities can improve this further. Simply, this indicates that postgraduate students in Sri Lanka are impacted by family and friends when they engage in green virtual learning. Thus, the universities can use testimonials of actual users (postgraduates) who used green virtual learning beneficially to motivate others. Perceived behavioural control is also affected positively by green virtual learning and this may mostly be because of the Covid-19 pandemic. Due to the

pandemic, students had to shift towards virtual learning which encouraged the use of the internet and these platforms saved energy by allowing students to create global classrooms and collaborations. Universities can influence this behaviour by implementing e-libraries and e-learning centres for postgraduates. Ecological conscience clearly shows postgraduates' greater intention towards virtual green learning practices. This may be due to their higher level of education and understanding they have about green virtual learning. This can be taken as a very positive fact as it encourages sustainable behaviour in postgraduates. Also, they will be able to motivate others towards these practices as society listens to educated people.

5.1. Limitations and future research

Sample size and the context of the study are major limitations of this study. Due to time and financial constraints, the sample was limited to 123 respondents from one state university. Future studies with a larger sample size representing postgraduates from other universities are therefore required. The second limitation pertains to the research design. This study used a cross-sectional design, wherein data was collected at one point in time. As behavioural intention is viewed as a psychological construct, longitudinal empirical studies are required to gain an in-depth understanding of future studies. The study used only four factors based on the theory of planned behaviour and literature. Additional variables specified in other theories might have an impact on the study phenomena, and future studies encourage the use of these for better contributions to the field.

6. CONCLUSION

Virtual learning is a major form of sustainable learning, and individual contributions, and actions are crucial in determining the success of this Green virtual learning. Due to a lack of knowledge and understanding about individuals' beliefs and behaviours when adopting green IT to virtual learning, proper implementation of green practices in virtual learning is problematic.

Therefore, the objective of this study is to examine the driving factors of adopting green information technology to virtual learning from an individual perspective. Mainly based on the theory of planned behaviour and previous literature regarding theoretical constructs developed and primary data collected from postgraduate context's individuals. Study results indicated that students' attitudes, personal norms, perceived behavioural control, and ecological conscience positively impacts the behavioural intention of green virtual learning adaptation of the postgraduate students. This study provides insights into the individual attributes that lead their behaviour to green virtual learning and results beneficial for implementing green practices of learning processes in emerging contexts.

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Significance of Green Retrofit Technologies: Perspective of Sustainability Pillars

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ABSTRACT

Green Retrofit (GR) technologies have been introduced as the solution to achieve sustainability in existing buildings. However, the significance of selected GR technologies could vary with their implications on the sustainability pillars of Environmental, Social, and Economic. Hence, this study was carried out to identify significant technologies in terms of the individual as well as all three pillars. A survey among a sample of thirty (30) experts who have been involved in green building activities and have sound knowledge of GR technologies offered their views on the relative significance of those technologies. The mean and standard deviation values were used to determine the relative significance. Afterward, ten (10) case study buildings were selected to analyze the results with industry practices. According to survey analyses, professionals consider energy efficiency as a prime tool to bring overall sustainability to the Sri Lankan context and indoor environmental quality as the next most preferred sustainability criterion. Among the thirty (30) technologies, solar energy power generation systems, energy-efficient equipment, and biomass boilers are the top three preferences when considering the overall sustainability perspective. These findings were further confirmed by the actual case studies of buildings of different types where these technologies have been implemented. However, this selection of GR technologies mostly depends on the business types and the project requirements. The study's findings enable industry practitioners to prioritize technologies based on their significance and sustainability implications, thereby improving the sustainability of built environments.

Keywords- GR Technologies, Social, Environmental, Economic.

1. INTRODUCTION

The primary role of the construction industry is to find a sustainable solution for construction to protect this planet through sustainable development. On the other note, sustainable development should be a pathway to sustainability.

The sustainability aspects address the three criteria: Environmental protection, social development, and Economic development (ESE). Therefore, the solutions for sustainable development need to simultaneously fulfill all three ESE considerations. This can be achieved by implementing suitable technologies. Thus, while selecting the technologies, rather than considering only the cost-benefit or carbon reduction, they have to focus on the simultaneous contribution towards the ESE aspects to achieve success.

A wide range of retrofit technologies have been applied throughout the world. Numerous studies examined their applicability, energy efficiency, and cost-benefit evaluation, and suggested suitable GR technologies. These studies can be categorized into two classifications, namely (1) empirical studies, (2) simulation studies. Empirical studies are followed by case studies or

interviews to get facts about the technologies, where simulation studies are followed by computer simulation models to get a consensus on what to do. These studies considered individual technologies or multi technologies.

However, concerning the statement given by the World Green Building Council (2013), every country and every region has its own distinctive uniqueness in terms of climatic conditions, cultures, and traditions, different building types, and dissimilar environmental, economic, and social priorities, while all these diverse characteristics make them approach green building in different ways. Similarly, Liu, et al. (2019) also found that the technologies are affected by many factors, including climatic conditions. In a study, Tan, et al. (2018) specified that the existing experiences with GR technologies may lead to unfeasible or unsuitable due to the distinctive climatic features, architectural characteristics, and construction standards of a specific region or country.

The literature also demonstrates that the technology selection may vary with the location and building typology. For example, Tan, et al. (2018) recommend 28 suitable technologies for GR's different development stages in Hong Kong. Specifically, the authors stated that space heating technology is not suitable owing to the hot and humid climate of Hong Kong. However, some cold climate countries, like the UK, Canada, require space heating technology (Chidiac, Catania, Morofsky, & Foo, 2011; Dascalaki & Santamouris, 2002; Dowson, Poole, Harrison, & Susman, 2012). According to Hong, et al. (2019), retrofit technologies have a different effect on different building typologies. The authors reviewed 29 papers and concluded that the preference order of technologies varies with the building typology. For example, building envelop is the most required technology for office and residential building, which is the second most important technology for other types of buildings. Though there are several pieces of research on green retrofit technologies, much less is known about their contributions to the ESE aspects. Further, a lack of knowledge about green retrofit technologies in the Sri Lankan context and their contribution to

sustainable achievement represents a significant knowledge gap that needs to be addressed.

Moreover, these generic suggestions do not have a significant potential to provide sufficiently detailed information for decision-makers to select technologies and not motivated enough to choose a different combination of technologies available in the market. Consequently, to support stakeholders to make decisions on green retrofit technologies selection to maximize the sustainability of existing buildings, this study aims to develop an optimization ranking list of retrofit technologies by understanding the sustainable perspectives in the Sri Lankan context.

2. MATERIALS AND METHODS

Quantitative research is more suited to finding out the extent of variation and diversity in any aspect of social life and involves quantitative data (Kumar, 2018).

This research was approached using quantitative methods involving quantitative data collected through a questionnaire survey. The questionnaire survey was administered to collect professionals' views on the significance of all available green retrofit technologies on sustainable aspects, including their cost implications, and savings potential.

The target respondents were identified as industry practitioners with more than five years of experience who have been involved in green retrofit projects. Due to the lack of access to the population list, the study adopts the non-probability sampling technique. Under that, a snowball sampling technique was used to obtain a valid sample size, which is the method used in the previous, green-related studies (Mao, Shen, Pan, & Ye, 2015; Zhang, Platten, & Shen, 2011).

To approach the initial respondents, the list of green accredited professionals with industry experience was collected from the Green Building Council, Sri Lanka.

Then the initially identified respondents were asked to share information regarding other appropriate participants to the study.

The sample of thirty (30) (out of 68) responses was obtained with the yielding of 44.12% response rate.

A sample size between 30 and 500 at a 5% confidence level is generally sufficient for many pieces of research. A summary profile of the survey participants is presented in Table 1.

Table 1. Profile of the survey participants

Experience (Years)	Response		Retrofit Projects Involved (Years)	Response		Designation	Response	
	No	%		No	%		No	%
5-10	11	37	< 5	18	60	Engineer	14	17
10-20	12	40	5-10	5	17	Project Manager	7	47
> 20	7	23	> 10	7	23	Quantity Surveyor	5	13
						Architect	4	23
Total	30	100	Total	30	100	Total	30	100

The developed questionnaire was structured into two main sections: The first section sought background information on respondents, including their names, organizations, designations, and experience in the construction industry, as well as the number of green retrofit projects involved. The second section solicited respondents' perceptions of the significance of each of the 30 proposed green retrofit technologies based on social, environmental, economic, and overall sustainability perspectives, using a 5-point Likert scale. The reason for adopting the 5-point rating scale in this study is that it provides unambiguous results that are easy to interpret (Tullis & Albert, 2013). Moreover, the 5-point rating scale has been widely used in previous studies to rate the relative importance of green technologies (Roufechaei, Bakar, & Tabassi, 2014; Zhang, Platten, & Shen, 2011). The collected quantitative data was analyzed by basic descriptive analysis via SPSS, version 20. Subsequently, the one-sample t-test was used to identify the significance of the identified technologies.

The one-sample t-test was conducted against the test value of 3, which is the middle point of the Likert scale (1-5) and at the 95% confidential level. The null hypothesis (H0) and the alternative hypothesis (H1) were considered as:

H0 = the technology is not significantly important for the green retrofit development (<0.05 p-value)

H1= the technology is significantly important for the green retrofit development (>0.05 p-value)

Following the questionnaire survey, ten (10) case studies were selected to recognize the widely practiced GR technologies in the industry. Therefore, four (04) garment buildings, one (01) spirits and wines, one (01) office, one (01) building that are certified under the LEED O+M Existing Building category were selected for this study. Since there were no LEED O+M certified hotel buildings in Sri Lanka, three (03) GR hotel buildings were also considered to identify the GR technologies based on the business type. The below tabular format represents the selected ten (10) case studies.

Table 2. Profile of the selected green buildings

Building	Rating System (Version)	Rating Level	Green Space	Business
GB1		Platinum		Garment
GB2		Gold		Garment
GB3	LEED O+M: Existing Buildings (v2009)	Gold	Industrial Manufacturing	Garment
GB4		Silver		Garment
GB5		Gold		Spirits and Wines
GB6	LEED O+M: Existing Buildings (v2.0)	Platinum		Garment
GB7	LEED O+M: Existing Buildings v4.0	Gold	Warehouse	Logistics
GB8				Hotel
GB9	N/A	N/A	Lodging	Hotel
GB10				Hotel

3. RESULTS

3.1. Questionnaire Survey

Through the literature survey and a preliminary questionnaire survey, 30 were identified. Table 3 summarizes the main findings of the survey results on the ranking of the overall sustainability and the individual significance of GR technologies based on their mean and one-sample t-test results, along with the respective major sustainable criteria as per the LEED green rating system.

Table 3. Summary of the significance of green retrofit technologies

Green Retrofit Technologies & Relevant Criteria		Overall Sustainability			Social			Environment			Economic		
		Mean	p-value	R	Mean	p-value	R	Mean	p-value	R	Mean	p-value	R
Solar energy power generation system	EA	4.337	0	1	3.833	0.001	3	4.733	0	1	4.433	0	1
Energy-efficient equipment	EA	4.167	0	2	3.633	0.007	13	4.533	0	2	4.333	0	2
Biomass boilers	EA	4.087	0	3	3.667	0.004	10	4.4	0	5	4.2	0	5
Efficient indoor plumbing fixtures and fittings	WE	4.010	0	4	3.733	0.001	5	4.4	0	3	4.2	0	4
Improvement of HVAC	IEQ	4.007	0	5	3.567	0.017	18	4.3	0	10	4.167	0	6
Ample ventilation for pollutant & thermal control	IEQ	3.947	0	6	3.967	0	2	4.133	0	14	3.733	0	17
Vertical plant	IEQ	3.927	0	7	3.767	0.001	4	4.2	0	12	3.833	0	11
Rainwater harvesting	WE	3.923	0	8	3.5	0.019	21	4.4	0	4	3.867	0	10
Green roof technology	EA	3.910	0	9	3.667	0.013	12	4.333	0	8	3.733	0	16

Technology	Cat												
On site waste water/ grey water treatments	WE	3.890	0	10	3.667	0.002	9	4.333	0	7	3.667	0.007	21
Water efficient, climate-tolerant plantings	WE	3.867	0	11	3.7	0.005	8	4.3	0	9	3.6	0.002	23
Sustainable lighting solution	EA	3.867	0	12	3.467	0.041	23	4.133	0	15	4	0	7
High efficiency irrigation technologies	WE	3.853	0	13	3.533	0.011	20	4.2	0	11	3.833	0	12
Wind technology	EA	3.850	0	14	3.367	0.048	25	4.367	0	6	3.933	0	8
Low- maintenance vegetation	IEQ	3.797	0	15	3.667	0.005	11	3.967	0	20	3.733	0	18
High efficiency automatic water control systems	WE	3.777	0	16	3.567	0.002	17	4.167	0	13	3.767	0.001	15
Smart windows- double/ triple glazing technology	EA	3.763	0	17	3.433	0.04	24	4.1	0	17	3.8	0.001	14
Occupant control of ambient and task lighting	IEQ	3.747	0	18	3.733	0.001	6	3.933	0	21	3.567	0.006	24
Light control and smart meters	EA	3.713	0	19	3.6	0.002	15	4.034	0	18	3.828	0	13
Negative pressure smoking rooms	IEQ	3.650	0.001	20	4	0	1	3.833	0.001	24	3.133	0.614	30
Geothermal technology	EA	3.643	0	21	3.267	0.161	27	4.103	0	16	3.633	0.001	22
Modern combined heat and power (CHP) systems	EA	3.627	0	22	3.467	0.011	22	4	0	19	3.667	0.002	20
Exterior and interior permanent shading devices	IEQ	3.610	0.001	23	3.621	0.01	14	3.767	0	26	3.467	0.028	27
Water less urinal	WE	3.587	0.001	24	3.333	0.077	26	3.933	0	22	3.667	0.002	19
Air filtration media	IEQ	3.587	0.004	25	3.733	0.005	7	3.833	0.001	23	3.2	0.339	29
Sunshine shading appliance	EA	3.560	0.001	26	3.533	0.007	19	3.8	0	25	3.467	0.02	26
Meter installation	EA/WE	3.540	0.005	27	3.167	0.475	30	3.5	0.033	30	4.233	0	3
Ground source heat pump technology	EA	3.383	0.026	28	3.2	0.312	29	3.633	0.001	28	3.333	0.086	28
Heat pump water heater	WE	3.367	0.023	29	3.233	0.165	28	3.667	0.001	27	3.9	0	9
Permeable surface technology	WE	3.230	0.088	30	3.567	0.001	16	3.6	0	29	3.533	0.002	25

3.2. **GR technology in the Case Study Buildings**

As seen from Table 4, irrespective of green certification grading, i.e., 'gold' or 'platinum', almost all similar types of buildings have incorporated a similar set of technologies, except

for a few technologies. Altogether, 22 technologies were found, and the technology selection varied with the building types. From the sustainability perspective, most of these retrofits implemented in selected buildings belong to the EA and IEQ categories, while some retrofits related to WE and retrofits related to SS and MR categories are not all implemented in these of one or more parts of the facility.

buildings. The main reasons for the limited adoption of green retrofits are that those features were already in the selected buildings and the building owners focused on achieving sustainability via sustainable strategies without involving any additions, rearrangements, deletions, or replacements

Table 4. Summary of GR technologies implemented in selected green buildings

Green Retrofits / Technologies	Sus. Criteria	GB1	GB2	GB3	GB4	GB5	GB6	GB7	GB8	GB9	GB10
Replace existing chillers with evaporative cooler	EA/IEQ	√	√	√	√	-	√	√	-	-	-
Replace oil fired steam boiler with biomass boiler	EA	√	√	√	√	-	√	-	√	√	√
Replace existing chillers with energy efficient chillers	EA/IEQ	√	√	√	√	√	√	-	√	√	√
Replace clutch motors with servo motors	EA	√	√	√	√	-	√	-	-	-	-
LED lights	EA/IEQ	√	√	√	√	√	√	√	√	√	√
Insulate steam lines	EA	√	√	√	√	-	√	-	-	-	-
Florescent lamps with sky lights	EA/IEQ	√	√	√	√	-	√	√	-	-	-
Compressed air line modification	EA	√	√	√	√	-	-	-	-	-	-
Biogas project	EA	√	-	√	√	-	√	-	-	-	√
Install Variable Speed Driver (VSD) for chiller	EA/IEQ	√	√	-	-	√	-	-	-	-	-
VSD for compressor	EA/IEQ	√	-	√	√	√	-	-	-	-	-
Recovery of flash steam for water heating	EA	√	-	-	√	-	√	-	-	-	-
Install low water flow push taps	WE	√	-	-	-	-	√	√	-	-	-
Key card for guest room	EA	-	-	-	-	-	-	-	√	√	√
Dual set point thermostat	EA	-	-	-	-	-	-	-	√	√	√
Solar hot water system	EA	-	-	-	-	-	-	-	√	√	√
LED televisions	EA	-	-	-	-	-	-	-	√	√	√
Solar PV system	EA	-	-	-	-	-	-	-	√	-	√
VFDs	EA	-	-	-	-	-	-	-	-	√	√

VSD for fresh water pump	EA	-	-	-	-	-	-	-	√	-	-
VSD for chilled water pump	EA	-	-	-	-	-	-	-	√	-	-
VSD for hot water pump	EA	-	-	-	-	-	-	-	√	-	-

4. DISCUSSION

An expert's opinion on the selection of GR technologies in the Sri Lankan green retrofit buildings was examined through an in-depth analysis of a questionnaire survey. Overall, the findings confirmed that the experts recommend implementing energy, IEQ, and water-related retrofits, while sustainable sites and materials were not much recommended during retrofitting, and the sustainability transition stage since they need major additions and alterations.

As shown in Table 3, out of thirty (30) technologies, twenty-nine (29) technologies are statistically significant towards achieving overall sustainability, where all 22 technologies identified through case studies were statistically significant. When considering the top ten ranked technologies, "solar energy power generation system", "energy-efficient equipment", "biomass boilers" and "green roof technology" (4 technologies) are from E & A criteria, "efficient indoor plumbing fixtures and fittings", "rainwater harvesting" and "on-site wastewater/ greywater treatments" (3 technologies) are from WE criteria, and "improvement of HVAC", "ample ventilation for pollutant and thermal control" and "vertical plant" (3 technologies) are from IEQ criteria. However, it should be noted that green roofing, rainwater harvesting, water treatment plants, and vertical plants were not implemented in the retrofitting stage of the selected buildings. The initial cost or alteration cost was not affordable for the investor, or lack of space availability could be the reason for this. For example, building GB9 has already fixed the solar panels on the building's roof. Therefore, green roofing is not suitable for that building.

Further, "permeable surface technology" is identified as statistically insignificant. The solar energy power generation system was ranked first (mean= 4.337). Further, the solar system is received the top ten rankings for individual perspectives as well. However, Roufechaei et al. (2014) identified the solar system as the third-ranked technology where insulation and energy-efficient lighting are having a higher rank than the solar system. Energy-efficient equipment is obtained the second rank (mean= 4.167) and biomass boiler as third rank (mean= 4.087). Accordingly, the first five ranked technologies are moreover in line with the findings of Roufechaei et al. (2014), where the order is not similar since the authors focused on housing development.

5. CONCLUSION

Many recent studies have reported the importance and need for existing buildings to be upgraded in order to improve their sustainability. This improvement can be fulfilled with the selection of suitable retrofit technologies. In this paper, the analyzed technologies were grouped into three major categories: E & A, WE, and IEQ. Though literature identified technologies under SS and MR categories, during the retrofitting they were not much implemented in the buildings. Most of these technologies under these criteria, such as parking spaces, roof installation, finishes, paving, have already been available in the existing buildings. Therefore, they were not commonly used during green retrofitting.

Overall, the findings of the current study show that the IEQ technologies have the highest consideration in the social perspective, whereas E&A technologies show their importance in the environmental, economic, and overall perspective. Furthermore, solar energy power generation systems, biomass boilers, and efficient indoor plumbing fixtures and fittings are the technologies that were identified as the top ten ranked technologies within all three

sustainable aspects. Though energy-efficient equipment, improvement of the HVAC system, and rainwater harvesting systems were not identified as significant in terms of social sustainability, they were preferred as highly contributing technologies to achieve environmental and economic sustainability. The literature survey results also show that energy-

efficient lighting, solar power technology, water-conserving appliances, biomass boilers, geothermal technology, and wind power technology are the most commonly used green retrofit technologies. However, wind power technology and geothermal technology are not widely used in Sri Lanka.

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Women Entrepreneur Empowerment Led by Digitization

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ABSTRACT

Women's entrepreneurship development is an effective strategy for the country's economic development. However, as it assists in increasing gross domestic production, creating employment opportunities, and narrowing the gender gap in the community, statistical data proves that Sri Lankan women entrepreneurs have not reached their full potential through their micro or small medium enterprises. Women still lag due to the lack of ICT literacy skills, which help in accelerating the growth of businesses. ICT is one of the ideal sources to overcome constraints that are unique to women entrepreneurs. This study aimed to assess the current environment for ICT for women entrepreneurship and explore the potential for leveraging ICT to support women's entrepreneurship. This study employs key informant questionnaires, online surveys, and focus group discussions to collect primary data using the snowball sampling method. The study uses the thematic analysis to assess the extent to which the country's environments are conducive to leveraging ICT for women entrepreneurship, identify gaps and challenges in the environment, and make evidence-based recommendations to address the gaps and challenges. The thematic analysis was conducted in the light of women's entrepreneurship development policies, financial services, business development support, effective usage of information and communication technologies for women entrepreneurs, and the usage of ICT in women entrepreneurs' participation in policy dialogue. The findings confirm that women entrepreneurs only use ICT for their businesses to a limited extent and encounter several challenges. such as, lack of an enabling environment, limited access to skills training, limited time, mobility restrictions, limited access to information, markets, and finance, attitudinal cultural barriers, and taboos. Most importantly, there is a significant gap between women entrepreneurs in urban and rural areas in terms of access, ownership, and usage of ICT. Moreover, the results reinforce the argument in favor of expeditiously implementing an effective multidimensional policy response on capacity development programs, improving infrastructure, and maximizing ICT specifically for business development systems in conjunction with access to finance initiatives for women entrepreneurs. The article emphasizes the potential of women entrepreneurs as an eye opener for the whole economy to tap an untapped potential for growth.

Keywords: Women Entrepreneurs, Empowerment, Information Communication Technology, Capacity Development

1. INTRODUCTION

It is well established in the womenomics literature that women's entrepreneurship development is a pertinent and important strategy for empowering women, creating employment opportunities, contributing to family wellbeing, and sustainable development of the economy. Women entrepreneurs in most developing countries do have micro, small or medium scale enterprises. There are some constrained barriers which hinder income, growth, and so on. These barriers consist of lack of support, limited access to skills development and information, time constraints, lack of financial market and financial support, attitudinal cultural barriers, taboos, etc.

With the development of ICT, the internet and network devices have become essential tools for daily business operations, and their development. The increased accessibility and affordability of ICT has resulted in increased mobile phone usage across countries, as well as numerous opportunities for entrepreneurs. In between the

period of 2008-2011 ICT services declined by 30% as per the results of decline in fixed broad band internet services globally. In 2013, mobile broad band subscriptions increased up to 2 billion while ¾ share was accounted for by the developing countries. (ITU, 2013)

Statistics show that women have barriers to usage and ownership of ICT, which keeps them away from the ICT revolution. In 2013, the ITU and UNESCO reported a rapidly widening gap in the developing world. Specifically, this study aims to evaluate the current environment for ICT for women entrepreneurship development. Explore the potential aspects of ICT to uplift women entrepreneurs. Recommend appropriate ways to influence suitable ICT tools for women entrepreneurship development.

2. LITERATURE REVIEW

Men and women who own enterprises are called entrepreneurs. They manage a company that undertakes new procedures to produce novel goods and services (Schumpeter, 1934). According to western world research, there are 3 main barriers against women entrepreneurship. such as the socio-cultural status of women, (Nafukho FM, 2010). the access to networks of information and assistance (Aldrich H, 1989) access to capital (Roy I., 2016). In many less developed countries, women have taken up the leading role in empowering their own families (Brush CG, 2006) and encouraging governments to establish and develop SME policies in the aim of eradicating poverty (Hailey, 1987)

Mora (2015) conventionally, technology-related careers require capabilities that are not commonly associated with women. Digital technologies have led to work become more flexible, and have cleared the borders between work and leisure time (Grönlund, In Search of Family-Friendly Careers? Professional Strategies, Work Conditions and Gender Differences in Work–Family Conflict, 2018) This creates both opportunities and challenges for women in terms of how to integrate work and handle family responsibilities. (Roy G., 2016). She mentioned that the use of mobile phones has helped women manage and schedule their family affairs efficiently

while working. Several researchers stressed the fact that women actually have less control than men over their work and schedules, and therefore today's working life has not yet well adapted to the expectations of modern women (Grönlund, 2018)

According to the organization for Economic Cooperation and Development (2004) the empowerment of SMEs is important in employments and Gross Domestic Production. Nevertheless, middle income countries enjoy significant benefits by contributing 70% of GDP and 95% of total employment in these countries (Ibid). In the Sri Lankan context, SMEs contribute to 50% of GDP, as well as 90% of the industry sector, but the contribution to employment and value addition has declined. SME supports to self-sustained development of economies (Muma, 2002). But factors like privatization, specialization, and corporate restructuring have also motivated the growth of SMEs (Solymossy E, 2001)

In reference to online businesses, online SME entrepreneurs tend to leverage the flexibility of the online environment to provide a novel experience to their customers, by lowering the cost, providing various choices, speeding up service, increasing socialization, or any combination of these different factors. (Zhang, 2014). (Shin, 2014). Further, online entrepreneurs tend to lower their operational costs (Daniel EM, 2015).

According to (Miah, 2006), the major barriers for entrepreneurs are the lack of sufficient investment, technology, difficulties in getting loans, poor physical infrastructure and asymmetric information, lack of skilled workers, lack of motivation for research and development, absence of a transparent legal system, low lobbying capacity, and rapid changes in policy implications.

Therefore, there is an urgency to investigate the untapped potential; women entrepreneur empowerment, led by digitalization, through analyzing the current context, challenges, and

future prospects in order to achieve sustainable economic development.

3. METHODOLOGY

A qualitative approach was adopted. Since it provides sufficient information by identifying the issues appropriately, His study has employed qualitative methodologies such as semi structured online interviews with online women entrepreneurs across the country, using the snowball sampling technique method. 70 online women entrepreneurs were found, based upon two criteria. Such as small or medium e-commerce business owners or women entrepreneurs with over three years of work experience. The questions were designed to capture the respondent's practical experience of their journey, risk handling, the present condition of the competition and the market, and future markets, as well as their expectations.

The research is based upon primary data and has been to "pop-up markets' to conduct focus group discussions. The revelation of the identities of interviewees and informants is withheld due to privacy and confidentiality concerns. The interviewees were based on the food and beverage industry, marketing and advertising, arts and creative industries, travel and tourism, health and wellbeing, clothing and accessories, and others across the country. Informants were shown the diversity in terms of their educational qualification, age group, marital status, and the range of experience, number of employees, and business sector they encountered. This diverse information provides a wide perspective about e–commerce engagement in these areas.

According to the sample, 40% of them are qualified with tertiary education and have obtained degrees and diplomas from different streams. They also engage in e- commerce business, which is totally unrelated to their earned educational qualifications. Consideration into age group factor most of them were in the age 20-30 group. And they were having successful relationships with their spouses and family members. They have strong support from their families for the upliftment of their businesses. And some of the respondents' employees were their family members and relatives.

The specialty of the sample is that 80% of the respondents have started their venture by investing 50, 000 LKR. Some of the respondents have participated in several pop-up markets and training programs in national and international workshops and platforms. Furthermore, they have utilized several online marketing strategies and specific strategies to create a market for themselves. Further, this study aims to provide theoretical understandings and empirical evidence on the impacts of ICT on women's entrepreneurship development in Sri Lanka and thereby seeks to provide insights to policy makers to improve the governments and non-governmental contributions, as ICT has the potential to facilitate, expand economic activities and to secure sustainable economic development.

4. RESULTS AND DISCUSSION

4.1. Women Entrepreneurs in Sri Lanka

Women entrepreneurs are of vital importance to the socio-economic growth and GDP growth of a country. Their value is of particular importance to developing countries with high levels of unemployment, poverty eradication, and income inequality. In Sri Lanka, there is still a lack of sufficient data on this sector, and it has proven to be a major impediment for the development of this sector. Despite the lack of a clear definition, some data can help provide some implications.

In Sri Lanka, most women entrepreneurs face several constraints, and both the financial and non-financial sectors' strategies were not sufficiently effective in uplifting these sectors. According to the statistics, 69 percent of females are in economically inactive labor force, while 34 percent of females are in an economically active population. (Statistics, Sri Lanka Labour Force Survey, 2012). This indicates the untapped potential for growth in the economy.

Entrepreneurship is a combination of demographic, association, environmental factors and process with support from the government, institution, and constitution (Kuratko D, 2004) Entrepreneurship development is essential to economic development by creating local employment, balancing area development, decentralization of economic power, and effective

diversion of profits into the community. According to previous literature, generally, it is estimated that SMEs employ 22% of the adult population in developing countries (Daniels, 1993). As Sri Lanka currently undergoes its transition period back to upper middle-income status, gender parity in access to education has been achieved through several policy implications. But unfortunately, women's economic participation is not up to a satisfactory level. According to the Sri Lanka labor force statistics, labor force participation rates for males and females are 65.7% and 34.3%, respectively. Further, women's participation in formal SME is not up to the necessary level, with most women lagging in informal micro-scale businesses. Therefore, these gender disparities represent an untapped opportunity to empower growth while solving the ageing population issues through the effective utilization of labor. In Sri Lanka, a higher proportion of the population is female, and they tend to be active as the second breadwinners of the family. Therefore, considering women empowerment through online SME will be a pertinent option in this pandemic situation and an effective way to sustainable economic growth.

E-commerce has the potential to empower women in many ways, and most developing countries have experienced this. Empowering women improves economic growth, increases employment opportunities, and they can further invest in education and the wellbeing of their families.

4.2. Information and Communication Technologies Infrastructure and Programs

The Global Information Technology Report 2020 ranked Sri Lanka's Networked Readiness Index at 83rd place out of the 134 economies (Lanvin, 2020). According to the statistics, in 2018, mobile cellular subscriptions in Sri Lanka accounted for 30.3 million, while it was 2.21 million in 2004. This has grown at an average annual rate of 22.19%. Furthermore, 22.2% of households owned a desktop or laptop (Statistics, 2019), while the usage of smartphones in Sri Lanka was 70.9%.

Apparently, Sri Lanka has started to invest in ICT infrastructure and e-government initiatives in accordance with several government policies. However, the data makes a distinction between male and female ICT users. Digitally literate female population is 41.1%, 25.4% use the internet and 9.7% communicate via emails. While the numbers are slightly higher for the male population (48% digital literacy rate; 33% internet usage; 13.5% email usage) (Statistics, 2019)

As we are in the knowledge-centric century, our competitiveness depends upon the integration of technology and the economy. The quality of life of people should be enhanced through creating a culture of technological innovation. Technological development has restructured businesses, industries, and economies. The digital economy presents various opportunities for the private sector with data driven business models.

The current digital transformation process in Sri Lanka can create a systemic transformation. The relevant authorities should focus on innovation led by women as it has a trickledown effect on the socio-economic sector.

ICTA's Digital Economy Strategy aims to utilize existing programs to develop and implement an integrated Digital Economy transformation across Sri Lanka through higher operational efficiency, lower costs, and better services. (ICTA, digital-Sri Lanka, 2020)

Constructing digital infrastructure is the most invested key strategy of ICTA towards a knowledge-based society through digitally empowered citizens. This initiative aims to reap the benefits of information and communication technologies, and the government has initiated a few effective, efficient, government services in parallel to this strategy. ICTA, Lanka Government Network (LGN) collaboration allows Lanka Government Cloud (LGC) to provide cost effective, reliable, and secure infrastructure facilities to ensure the vision of spatial growth in economies (ICTA, 2020)

4.3. **Information And Communication Technologies Usage and Barriers**

According to the discussion, 40% of women entrepreneurs have access to mobile phones, the internet, and computers. While a 40% only owns a mobile phone without the internet facility, and 11% of them do consider usage of ICT is a disturbance for their busy schedule. While 9% feel reluctant to use ICT due to a lack of skills,

But women entrepreneurs in Sri Lanka use the internet on computers reasonably frequently for a different range of activities. However, most of the activities are still relatively basic, such as the use of social media to market their products, purchasing or ordering raw materials, and sending e-mails. Business development requires more advanced ICT skills in selling products or services online, promoting products or services using ICTs, or finding a customer base are undertaken most frequently with advanced ICT devices and options. Only 10% of respondents stated having a website for their business.

Therefore, a lack of ICT skills is one of the key reasons for the relatively low rate of ICT usage. The majority of respondents intend to use ICT tools for business, expect to learn the ICT skills, but low confidence is a barrier. This is confirmed when the women were asked to list the barriers to the usage of computers, mobile phones, and the internet. The most common response was a lack of training.

Another main barrier was finding a broad customer base, suitable market. The respondents mentioned the need to obtain greater support from relevant organizations to expand their business. Moreover, financial support from financial institutions was also not at a satisfactory level as they asked for a lot of documentation, collateral, and high time consumption. The next larger concern was marketing and tackling the competition after the establishment of the venture. The usage of ICT plays a prominent role in this aspect.

In terms of social barriers for women entrepreneurs, they were managing work life balance as the second breadwinners of their families. According to the analysis, most women tend to engage in online businesses due to the effective balance between work life and personal life management. And some of them wanted to improve their leadership skills and confidence. While others wanted to gain primary experience in the aspect of competence to start their own venture.

The group discussions revealed that most of the women had faced several circumstances in balancing their professional and family life. Most of them had stopped going to jobs, as family commitment comes first. And they were not able to concentrate on their career development. Furthermore, continuing their higher education while working was another challenge as they are under the supervision of employers. Furthermore, as the second bread winner in the family, they do have certain responsibilities to fulfill. Therefore, most of them tend to start ventures on online platforms.

Most of the women have pursued tertiary level education from different streams and 70% of them have settled themselves into different ventures which are not related to their degree/diploma field. Most of them were driven by intuition, and they believed exploring new opportunities, and taking up new challenges would lead to a way to be successful in their ventures. They have started different ventures after several experiments, experiences they have collected along the journey. Furthermore, these brave decisions were motivated by the pertinent requirements of the customers, increasing demand, and economic or family related reasons.

Moreover, lack of proper guidance from the public and private sector to ensure the guidance and support to E- commerce entrepreneurs. Due to a lack of regulations, banks are also reluctant to offer financial loans to them. Besides, some of the business accounts were cyber attacked or hacked by the fraudsters. And entrepreneurs were misled by providing wrong details, canceling orders at the last moment, not paying money and spreading negative feedback around the network.

Due to the lack of a legislative system and responsible authorities to take care of them, online ventures were severely damaged and demotivated in the above scenarios.

Majority of the Focus Group Discussions stated their expectations incline with the ICT technologies 46% expressed their intention to

acquire advanced ICT skills, as they play a vital role in accessing, financing, and finding customers and workers. While 30% are planning to start their own website and to manage orders through that.

Most importantly, every business owner wants to expand their business to the next level while achieving the constraints they do encounter towards the progress of their business.

5. RECOMMENDATIONS

The following recommendations are based upon the focus group discussion and key informant interviews.

The majority of women are concentrated in low growth, low profit sectors. With technological development, there is a diverse range of ICT enabled business opportunities for women. For instance, e- commerce, freelancing activities, and ICT service provision.

The establishment of a capacity development program is essential as there are some women entrepreneurs who do have the capabilities but lack the skills to initiate an effective venture. Therefore, the programs that cover training, financing, mentoring, and business development should be created after the greater awareness campaign. The awareness campaign can be conducted using printed, electronic, social media, regional organizations, and word of mouth. Further, enhancing the quantity and quality of women entrepreneur association, NGO, universities and vocational schools is another effective way to start the WED. Furthermore, training can be conducted as short workshops, while more advanced modules include workshops such as approaching export markets as a collaborative work of public private partnership.

For lack of motivation, lack of confidence, and limited time constraints, e- commerce agents can be introduced to regions in order to handle their websites, social media, etc., with the idea that eventually the entrepreneur will learn to do it on their own. Simply, it increases the awareness of their product while also increasing their customer base.Enabling a mentor program with successful ventures with ICT usage is essential. As they can share their experience while being an inspiration, support system to the women entrepreneurs by

delivering a well-structured, focused mentoring program.

As an initial step, an SMS based information sharing service for women entrepreneurs can be established. And in the discussion, they were ready to pay a certain amount if there was a fee for this service. This is mostly suitable for entrepreneurs who live in urban and peri urban areas, as it connects customers, sellers, and organizations in an effective manner.

Establishment of loanable funds for women entrepreneurs to purchase ICT related equipment can be conducted with the collaboration of financial institutions, NGOs, and telecommunication agents. Nevertheless, improving financial literacy in terms of credits, debits, savings, and investment is also required for sustainable development in this sector. Most importantly, establishment or improving the quality of internet connection is required in terms of infrastructural development towards the sustainable and fast development of women entrepreneurship activities.

6. CONCLUSION

According to the findings of the study, information and communication technologies offer opportunities for women entrepreneurs to enhance their skills and experience for the sustainable development of women entrepreneurship. Most of them do have a clear understanding of what they should do to improve their business, competition, and the opportunities ahead. They are mainly inspired by creative ideas rather than commercial purposes, and they tend to earn higher profits due to their hard work, creativity, and strategic skills in their ventures. But they encounter several challenges, including a lack of skills, a lack of legal support, and a lack of financial support, along with the cheap imported products. In order to overcome the barriers, public private partnerships should be built and support them in the aspects of capacity development, technology handling, exploring new markets, and a strong legal system. Along with the financial support and guidance, they need to continue their journey.

Engaging in e- commerce businesses has led them to reduce being a burden to the government,

steady income, secured employment status, enhance creativity, and be a leader in society while generating income, and making a way towards sustainable development.

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Empowering Women Entrepreneurs in Digital Age: Online Community Approach

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ABSTRACT

Women Entrepreneurs are a valuable resource that has an abundant potential to flourish in the digital age. Social media platforms are considered a prominent mode of today's online businesses. However, according to recent statistics, only 10% of online businesses handled by women entrepreneurs have continued successfully for more than a year. As per literature, this was primarily influenced by the lack of technological and managerial skills required. Thus, this study focuses on designing and developing an online community-based platform to create a peer support mechanism to collaborate and learn how to use social media platforms for business purposes. The key focusing areas were the current usage of social media platforms in business, and perceived challenges, technology acceptance, and design insights on Information and Communication Technology (ICT) supported intervention to bridge the identified gaps. Since the study is primarily exploratory, the Unified Theory of Acceptance and Use of Technology (UTAUT) model was used. Data was gathered from a representative sample of women entrepreneurs in the Colombo district. The results indicated that over 80% of the respondents use social media for different business purposes. The evaluations indicated that performance expectancy and effort expectancy significantly influence the intention of women entrepreneurs to use the ICT based solutions.

Thus, a web-based prototype was proposed as a solution to develop online communities for women entrepreneurs to collaborate and learn. The findings of the study would contribute to the future design and development of ICT supported interventions to empower women toward successful business ventures.

Keywords: Women Entrepreneurs, Social Media, UTAUT, SMEs, Sri Lanka

1. INTRODUCTION

The advancement in ICT has made significant changes in people's lives, especially in terms of consumption and how businesses are conducted (Puriwat & Tripopsakul,2021). Social media (SM) is a widespread alternative platform to initiate business ventures inexpensively, with minor technological knowledge requirements. As a result, unlike a physically located business, online platforms enable entrepreneurs to increase their visibility and penetrate many new market segments to market goods, services, and brands globally. Therefore, social media is considered the best marketing tool nowadays.

The knowledge and skills required for an online business are mainly technical. But there is a widespread belief that Women Entrepreneurs (WE) are more technologically

challenged than their male counterparts (Sihotang, 2020). The WEs are at the forefront of global economic development in developing countries, where entrepreneurs that make up most of their countries' economic growth contributions consist of Small and Medium Enterprises (SMEs) (Gamage, 2003). However, in the Sri Lankan context, only 25% of total SMEs are owned by WE (EDB, 2021). Despite achieving gender parity in education, the below-average participation rate indicates the untapped potential of the WE in Sri Lanka.

When considering social media, the number of users in Sri Lanka has increased by 1.5 million, amounting to a 23% increase between 2020 and 2021. Also, the growth rate of Social Media users is at 23.4%, which is higher than the global rate of 13.2% (Simon Kemp, 2021). This indicates a higher number of business opportunities generated by potential customers gathered avidly around SM Platforms. Therefore, in this study, the research was focused on Empowering WEs in the digital age using an online community in Sri Lanka.

1.1. **Research Objectives**

The objectives of this research were;

i. To explore the SM platforms used by WEs for their business needs.

ii. To investigate the purposes of using these SM platforms.

iii. To identify the challenges faced by WEs when using SM platforms.

iv. To ascertain the acceptance of technological solutions bridging the identified challenges.

2. LITERATURE REVIEW

2.1. **Social Media as a Business and Marketing Tool**

SM is an interactive platform utilising content created by its users and members. Over time, SM has adopted business accounts to conduct online business activities among its users. Therefore, businesses now use SM to acquire helpful knowledge, conduct marketing activities, increase sales, and deliver customer services (Scuotto et al., 2019). As such, SM is now considered an indispensable resource in Digital Marketing. It needs meticulous monitoring and adjusting to the current trends in the global market to maintain its effectiveness (Opreana & Vinerean, 2015). As per most literature, online businesses need four main capabilities to build a successful marketing background. 1) engaging and relevant marketing content, 2) ability to utilise the Search Engine Optimisation (SEO), 3) using the most relevant social media platform/s, and 4) building and maintaining marketing communications that are capable of convincing consumers to buy the products and services sold (Sihotang, 2020). If these four capabilities are available, most online businesses can thrive in the global market and benefit from the highly cost-effective nature of digital marketing when using social media.

2.2. **SMEs and Women Entrepreneurs**

SMEs play a pivotal role in economic growth and development due to employment generation, economic empowerment, the broader distribution of wealth, and poverty alleviation in general (Harvie & Charoenrat, 2015). Even though the literature does not provide a clear definition for SMEs, it is addressed in many types of research highlighting the importance of the presence of SMEs in many countries for its economic growth and development (Humphrey, 2003; Papa et al., 2018; Robu, 2013; SAVLOVSCHI & ROBU, 2011).

SMEs require entrepreneurs to maintain close and committed relationships with their customers (Abed et al., 2015). SM can play a major hand in this. Among these entrepreneurs, however, there is a significant lack of WEs. The Total Entrepreneurial Activity (TEA) represents the no. of legally accepted entrepreneurs (between ages 18 to 54). According to a report from Babson College based on information taken from the Global Entrepreneurship Monitor (GEM), in 2019, of 59 economies, the TEA rate of women

globally is only 10.2%. However, the TEA rate of low-income countries

is 15.1%. These results showcase the potential of WE to enter the market as SMEs (Ukpere et al., 2014).

2.3. Usage of Social Media by SME Women Entrepreneurs in Sri Lanka

The WEs in Sri Lanka amount to only 25% of the total SMEs. As per the information provided by the WEs Development Program, despite achieving gender parity in literacy, the gap in economic participation of women and men amounts to 40% and 73%, respectively. This indicated the lack of incentives and encouragement provided to women to actively participate and contribute towards the economy as the dominating population segment. Moreover, along with higher unemployment rates, women represent a staggering 20.4% of unpaid workers among family workers than 3% of men in Sri Lanka (EDB, 2021).

Sri Lanka, which had a patriarchal society during the early 1980s, eventually changed due to technological and sociological development (Vithanage, 2016). However, the opinion that "men are better at business than women who are technologically challenged" seems to be still accepted in some rural areas.

Research conducted in 2018 indicated that globally only 10% of online businesses had operated successfully for more than a year (Phonthanukitithaworn et al., 2019). In relation, Sri Lankan WEs seem to be significantly affected by the lack of knowledge and skills on the technological and managerial aspects required to maintain their businesses successfully (Attygalle et al., 2014). Apart from a few research materials and online communities exclusively for registered members, there is a lack of support or guidance provided to WEs regarding the requirements essential for maintaining an online business in Sri Lanka. Therefore, this research was conducted to address this gap of knowledge identified.

3. METHODOLOGY

3.1. Research Model

3.1.1. Theory of Technology Acceptance Model (TAM)

The TAM model predicts a tool's acceptability and identifies improvements and amendments required to make a system acceptable to users. In this study, the TAM model is used as the base to examine the acceptance and adoption of SM platforms by WEs in Sri Lanka.

3.1.2. Unified Theory of Acceptance and Use of Technology (UTAUT)

The TAM Model has several disadvantages. Therefore, an extension of TAM named the Unified Theory of Acceptance and Use of Technology (UTAUT) was used (Venkatesh et al., 2003). In this study, UTAUT is used as the main theoretical framework to evaluate the ability and requirements needed by WEs when operating a business on SM Platforms.

3.1.3. Theory of Planned Behaviour (TPB)

The Theory of Planned Behaviour (TPB) is an extension of the Theory of Reasoned Actions (Ajzen & Fishbein, 1977). It introduces a new Perceived Behavioural Control (PBC) parameter to two parameters named Behavioural Attitudes and Subjective Norms. In this study, Perceived Regulation of Behaviour (PBC) is determined by the perceived value and availability of resources, opportunities, skills, and capacity to achieve results that affect the user's behavioural intention, which is the key component of the model.
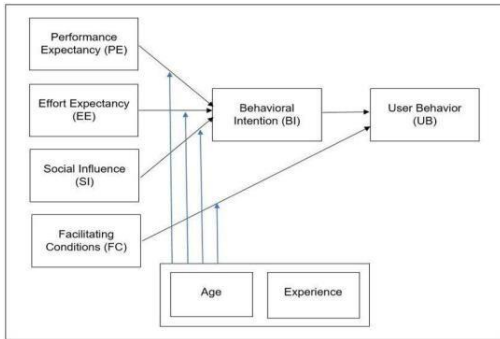
3.2. Conceptual Framework

Figure 1. The Proposed Conceptual Framework

According to the Conceptual Framework, the Behavioural Intention (BI) to use SM for business purposes by WEs is affected by four constructs named Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), and Facilitating Conditions (FC), which are the independent variables in this study. In contrast, the mediate variable is the BI, and User Behaviour (UB) is the dependent variable. In addition, the moderating effects of Age and Experience were also considered in this study.

3.3. Research Hypotheses

The hypotheses developed for this study were as follow:

H1a: PE significantly influences the BI of WEs to use SM for business purposes.

H1b: EE significantly influences the BI of WEs to use SM for business purposes.

H1c: SI significantly influences the BI of WEs to use SM for business purposes.

H1d: FC significantly influences UB of WEs to use SM for business purposes.

H1e: BI has a significantly positive effect on UB.

3.4. Data Collection

Surveys and semi-structured interviews are the primary data sources used in this research. In contrast, statistical reports from governmental authorities and other literary sources like research papers, journals, and publications were referred to as the secondary data sources.

A total of 200 responses were collected from the survey, which included 174 females and 26 males. Out of the 174 females, only 132 operate their businesses in the Colombo District. Also, 42 WEs and 26 Male Entrepreneurs were ignored as outliers. Therefore, the response rate was measured at 66%. The analysis was performed using the IBM SPSS Software (Version 27).

4. DATA PRESENTATION AND ANALYSIS

4.1. Data Presentation

The primary source of information was the survey circulated on SM. Based on responses, only 20% have legally registered, while 40.2% are planning to register their business consequently. The number of WEs seems to descend as age increases. As a result, most WEs were found between 18 to 30 years, amounting to 65.2% of the responses. 45.5% of WEs were Graduates, and only a mere 4.5% were GCE O/L completed school leavers. Most businesses are involved in the Arts and Crafts business category (28%), followed by Food and Beverages (22%) and Apparels and Clothing (0.8%). Furthermore, most businesses do not have any employees (69.9%). In comparison, more than 50% of WEs operate their business as a hobby whenever possible. However, over 80%t WEs have a SM presence in their business in Colombo District.

4.2. Data Analysis

4.2.1. Reliability Test

The reliability of the questionnaire was measured using Cronbach's Alpha which determines the internal consistency of the test items. As illustrated in Table 1, the alpha values for each construct were calculated and compared with the generally accepted minimum value of

0.7 to measure the reliability (Bujang et al., 2018). Since all the values are above 0.7, the constructs used in the study were considered interrelated and reliable.

Table 1. Reliability Analysis of Construct Data

Construct	Responses	Items	α Value
PE	107	5	0.885
EE	107	4	0.903
SI	107	4	0.712
FC	107	4	0.774
BI	107	4	0.817
UB	107	4	0.743

4.2.2. Normality Test

A normality test was conducted to check the univariate normality of the dataset. Since all the values of skewness and kurtosis were within the range of values of skewness at [-2,2] and kurtosis at [-3,3] (Hair et al., 2010), the dataset was determined as acceptable for this study.

4.2.3. Goodness-of-fit Test

Table 3: Hypotheses Testing

According to the model summary, the R^2 value was higher than 0.5. As a result, it is concluded that the responded data is positioned around its mean and is a better model which fits the dependent variable with independent variables

Table 2. Model Summary[b]

Model	R	R2	Adjusted R2	Std. Error of the Estimate
1	0.863[a]	0.792	0.774	0.571

a. Dependent Variable: UB

b. Predictors: (Constant), PE, EE, SI, FC

4.2.4. Hypotheses Test

A correlational study can determine how the variables are related to the collected data. A 5% degree of significance was chosen to support the hypotheses in this study. Since all the individual hypotheses indicate a level of significance below 5%, the Null Hypotheses were rejected while the Alternative Hypotheses were accepted. The positive relationships support the study's expectations regarding WEs BI to use SM Platforms for business purposes.

Table 3 : Hypothesis Testing

Hypothesis	Relationship	Estimate (b)	Result
H1a	PE → BI	0.643	Accepted
H1b	EE → BI	0.669	Accepted
H1c	SI → BI	0.432	Accepted
H1d	FC → UB	0.405	Accepted
H1e	BI → UB	0.576	Accepted

The correlation between PE & BI was supported (H1a: b= 0.643, t-value = 8.594, sig < 0.001). H1b presumed that EE significantly positively impacts BI, which was also supported (H1b: b = 0.669, t-value = 9.232, sig < 0.001). H1c suggested that SI had a significant positive impact on BI which was also supported (H1c: b = 0.432, t-value = 4.909, sig < 0.001). H1d postulated that FC significantly positively impacts UB which was also supported (H1d: b = 0.405, t-value = 4.603, sig < 0.001). BI had a significantly positive effect on UB (H1e: b = 0.576, t-value = 7.225, sig < 0.001).
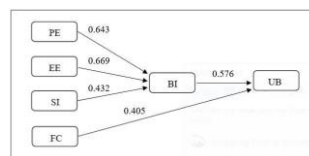

Figure 2. Structural Model

4.2.5. ANOVA Test

An ANOVA test was employed to test the effect of moderation of demographic and behavioural variables, namely Age and Experience, on the levels of four exogenous (PE, EE, SI, and FC) and two endogenous variables (BI and UB) through regression technique. In this study, the Age variable affects only SI, FC and UB constructs, while the Experience variable affects all except FC.

Table 4: ANOVA Analysis

	ANOVA				
	Sum of Squares	df	Mean Square	F	Sig.
SI x Age	7.588	7	1.084	4.421	<.001ᵇ
FC x Age	15.869	7	2.267	4.166	<.001ᵇ
UB x Age	30.056	7	4.294	4.231	<.001ᵇ
PE x Experience	3.282	1	3.282	14.686	<.001ᵇ
EE x Experience	4.510	1	4.510	16.683	<.001ᵇ
SI x Experience	9.960	1	9.960	15.649	<.001ᵇ
BI x Experience	6.608	1	6.608	33.186	<.001ᵇ
UB x Experience	67.883	1	67.883	3135.253	<.001ᵇ

5. DISCUSSION AND CONCLUSION

5.1. Discussion

The research findings on Hypotheses have indicated that EE has the dominant predictability towards BI compared to PE and SI. It suggests that WEs usage of SM for their businesses is easy and provides a significant advantage. Also, the 80% of WEs in the convenient sample with an online business in SM platform/s confirmed this point. Therefore, it can be concluded that WEs are already aware of SM Platforms as an alternate business platform that can enhance their business performance.

The sample has indicated that Instagram has taken over Facebook in terms of popularity (Statistica Research Department, 2021). In addition, PE was indicated as the second most vital aspect influencing BI. This finding is consistent with the idea that even though SM Platforms are easily accessible by WEs, it is somewhat difficult to maintain and analyse feedback received by the platforms (Crammond et al., 2018). This shows that PE has a significantly positive influence on BI. Therefore, even though business accounts are easily initiated, it takes considerable effort to maintain a business online.

The results indicate a positive relationship between SI and BI. This shows the significance of SI when adopting SM for business in line with previous research (Nawi et al., 2017). The study is also in line with research that has businesses (Phonthanukitithaworn et al., 2019). This is reflected by the fact that over 70% of WEs in this study requested Managerial and Technological support claimed that FC in the usage of SM has positively influenced its adoption for business activities (Venkatesh et al., 2003)since it indicates a positive relationship with UB

5.1.1. Practical & Managerial Implications

SM has become more predominant due to the Covid 19 pandemic, which has caused a global recession. SM is also cost-effective and easy to implement. Therefore, by popularising business operations via SM Platforms, Sri Lanka has the ability to increase the contribution of WEs. Furthermore, by increasing the managerial and technological knowledge of the existing and potential SME WEs, could significantly reduce the annual business failure rate measured at 90% of global online

5.1.2. Solution Development

Over 80% of the entrepreneurs are millennials, and many have a high literacy rate. Therefore, a website was created considering the familiarity and general knowledge required to use the given solution. Even though Instagram was selected as

the most popular SM Platform among WEs, it was not considered to deliver the solution since it prioritises more visual aspects and highlights posts.

To appeal towards WEs the theme was selected in shades of pink and purple while the home page, events page, calendar, community page and courses & guides page were organised based on models known for User Experience satisfaction.

Figure 3. Home Page

Figure 4. Courses & Guides Page

Figure 5. About Us Page

5.1.3.   **Limitations and Recommendations**

There are over a million WEs in the country (Department of Census and Statistics, 2014), and it is challenging to gather responses from most of them. Therefore, the sample was limited to WEs in Colombo District. As a result, the findings might be biased towards a more urban setting, making the results inapplicable to Sri Lanka as a whole. In addition, the study has not specified an industry. Therefore, a narrowed view of an industry cannot be predicted regarding WEs. Furthermore, there is no nationally accepted definition for SMEs, which is considered as a limitation in this study (Attygalle et al., 2014). Moreover, due to the lack of legal registration requirements, all online businesses were considered to mitigate bias.

Based on these limitations, it is commendable if more research is conducted based on other technological acceptance models to enrich understanding of the research topic. Furthermore, it is recommended to increase the research sample enclosing the whole country to give a more applicable and standard opinion on research results.

5.2. **Conclusion**

This study was conducted mainly to understand and provide a solution to bridge the gap of over 90% of annual failed online businesses. During the literature review, we identified that the failures seem to be mostly due to WEs' lack of managerial and technological skills to continue online businesses successfully. To confirm this opinion and provide a suitable solution, a pilot test with brief semi-structured interviews and a survey was conducted to gather information, which was later analysed based on hypothesis testing, where the alternative hypotheses were all accepted. Therefore, it can be concluded that the research objectives were all achieved successfully.

For future extensions it is recommended to carry out this research based on a higher sample consisting of WEs from every district in the country to mitigate bias and provide a more overall view of WEs in Sri Lanka.

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Integration of Marketing Innovation, and Brand Value in enhancing Brand Competitiveness: A study on small and medium-sized enterprises (SMEs) in emerging countries.

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ABSTRACT

Small and medium-sized enterprises (SMEs) are functioning in a dynamic corporate environment where SMEs are on the lookout for novel strategies to market the brand and stand out from the competition. Gaining competitive advantage has become an important goal for the SMEs and hence has led to brand competitiveness an important factor to focus on. Brand competitiveness would allow for the organization to initiate the right marketing strategies to compete with other competitors in the market. Extant literature studies how brand competitiveness helps in survival for the brands but little is known about how brand value and marketing innovation would impact the brand competitiveness in the customer's perspective of SMEs in emerging countries. The main objective of the research was to examine the influence of brand value and marketing innovation on the brand competitiveness of SMEs in emerging countries. Descriptive and inferential statistical analysis was used to display the associations of the independent variables within each construct. The quantitative findings from 103 customers were analyzed using Statistical Package for Social Sciences (SPSS) version 21 and AMOS 21 to indicate that brand value and marketing innovation develops brand competitiveness among SMEs in emerging countries. The findings of the study would contribute to the current marketing literature available to be adopted by SMEs to develop customer perception and build brand competitiveness with the use of the right innovative marketing strategies and by improving brand value.

Keywords - Brand Value, Marketing Innovation, Brand Competitiveness, SMEs, emerging countries.

1. INTRODUCTION

Competitive markets have led organizations to strive to survive, grow and build their brands and businesses irrespective of how big or small. Small and medium-sized enterprises (SMEs) are vital for emerging markets and are functioning in dynamic environments providing homogenous products and services. Existing literature states that the gross domestic product of most emerging markets is influenced by the economic activities contributed to by the SMEs (Odoom et al., 2017) and also drives innovation and competition in the market (Beneke, et al., 2016). SMEs also contribute to the majority of the number of corporations in developing nations (Johnson, 2015). Tools including the marketing activities of organizations affect the SME goals (Johnson, 2015) and in turn, would affect the competitiveness of an organization. Marketing allows SMEs to educate and inform their potential customers about the organization, brand and what they offer. Brands in emerging markets are working tirelessly towards being

up-and- coming, yet the brand building stage in these markets is still quite in the early stages (Wang et al., 2017). SMEs need to improve their brand competitiveness (BC) and this study aims to examine if BC could be influenced through the combination of brand value (BV) and marketing innovation (MI).

Literature from studies conducted states that the BC is influenced by both BV (Gupta et al., 2020) and MI (Gupta et al., 2016) whereas in both studies a significant relationship has been established. Managers of SMEs are required to take into consideration the influencing factors of BC to ensure that the business will be competitive in a vigorous environment.

MI could have an impact on the enhancement of the BC of an organization. SMEs find the strength of the brand to be an intangible resource (Parnellet al., 2015). This could be achieved by the BC that the SME has against other competitors which could be supported through MI. MI refers to what the companies would invest in the aim of marketing to the customers using a new method (Medrano et al., 2020). There is a need for more literature in relation to MI (Medrano et al., 2020). For companies, BV allows for the organization to become more competitive in the market (Gupta et al., 2020) by achieving the same via brand differentiation to drive BC.

Emerging markets have lower-income but the economies are growing while using economic freedom as their primary mode of growth (Sharma et al., 2018). This new freedom could lead to a dynamically changing market in which SMEs are to survive. The problem lies in how these SMEs are to survive and one way of doing so is how they are competitive in the market. This can be explored in detail by understanding how BC would impact these organizations.

The following study will be focused on understanding the impact MI and BV have in aiding the enhancement of the BC of the organization. This is accomplished by understanding the significant relationships between the variables BV, MI and BC. MI & BC as well as BV and its relationship with BC

has been studied as separate relationships. However, literature on how these two variables integrated could drive BC lacks literature and a gap can be identified. This study aims to bridge this gap by exploring how the combined factors would affect BC while also understanding this from the perspective of an SME in an emerging market.

Understanding the relationship and impact of BV and MI on BC is a question that is required to be studied. The problem statement of the study has been identified as the lack of knowledge of the SMEs to be competitive in the homogenous market. As a large number of SMEs exist in emerging countries and with the contribution of these SMEs to the economies of emerging countries it is important for these organizations to be competitive and surviving is vital. In Sri Lanka SMEs account for 75% of the enterprises of the country (Ministry of Industry and Commerce, 2021) this accounts to a large portion of the economic growth being dependent on SMEs and also depicting large competition for these SMEs.

This study aims at enhancing the understanding and knowledge concerning the impact of brand value, and marketing innovation on brand competitiveness related to SMEs in emerging countries.

Accordingly, this study focuses on two research questions namely:

1. What is the extent to which Marketing Innovation is related to Brand Competitiveness?
2. What is the extent to which Brand Value is related to Brand Competitiveness?

Based on the above-mentioned questions, the research objectives are as follows:

1. To evaluate the effect of Marketing Innovation on Brand Competitiveness.
2. To evaluate the effect of Brand Value on Brand Competitiveness.

The following study would significantly contribute to the literature available on SMEs in emerging countries to understand the importance of BC and strategically build the

right methods to improve BV and engage in MI. Thereby, the study would bridge the gap existing in the literature studying the impact of BV and MI on BC for emerging country SMEs. The principal benefit of this study would be acquired by the large number of SMEs owners who would be able to understand the developed framework developed based on the Dynamic Capabilities Theory.

The study in brief would consist of five sections. The following section would consist of the literature review clarifying about the selected variables with the support of already existing literature and the conceptual framework developed to be tested. The third section would be focused on the data collected, the constructs and data collection. The fourth section would analyze the already collected data, which would aid the fifth and final section that would explain the conclusion of the data findings, the implications and limitations of the study.

2. LITERATURE REVIEW

Research conducted for emerging markets has identified that a lack of understanding of marketing infrastructure in emerging markets could lead to low profitability and lower market share (Sharma et al., 2018). In order to overcome this issue, it has been identified by prior research that it is required to develop marketing strategies that would allow overcoming these challenges faced by organizations (Sharma et al., 2018). Branding for an SME is a long-term investment that does not attract the SMEs as there are no short-term financial prizes for the firm (Lin et al., 2019). However, it is important for the brands to be competitive and significant in the market for SMEs. This research identified three main factors that could contribute to an organizations brand success in an emerging market, namely BC, BV and MI.

2.1. Brand Competitiveness

BC allows for organizations to lead the market ahead of their competitors (Gupta et al., 2020). BC allows for brands to be a step ahead of their competitors in the marketplace (Gupta et al.,

2020) while displaying their competitive advantage (Baumann, 2018). Marketing is an indicator of competitiveness (Ahmedova, 2020) and adequate knowledge in this regard would allow for the SMEs to be more competitive in the energetic and changing market with a level of value and innovation incorporated in their marketing activities. Prior studies suggest that organizations in emerging markets strive to grow to become strong global brands (Wang et al., 2017). For organizations to ascend to a global platform from being an SME one needs to compete effectively in the market. As project success is an important dependent factor for an SME success (Goerzig & Bauernhansl, 2018), this could also be the same when we look at marketing projects and activities of an organization. The ultimate result expected from brand competitiveness for an organization is to elevate the overall performance of a brand based on the unique marketing activities (Gupta et al., 2020a). These activities would thereby contribute to create BV.

2.2. Brand Value

BV permits organizations to achieve leading competitiveness in the market (Gupta et al., 2020). BV allows for emotional and rational value for the customers (Gupta et al., 2020) which are also the constructs that would be used to measure brand value in this study. Simply, brand value is how the customers relate to and connect with the brand (Gupta et al., 2020). Building connections with and a perceived value with a customer is one way a SME can be competitive in the market. BV also depends on the actions of the customers as well for organizations (Gupta et al., 2020) which could influence the purchasing decisions of the customers. Existing studies have identified that BV is based on what customers believe to be the perceived value for the buyer (Merz et al., 2018). BV allows for the performance to be driven for organizations (Muhonen et al., 2017) which is also related to the supporting of goals in an organization. BV can also be created by MI which could contribute to BC.

2.3. Marketing Innovation

MI is viewed from a commercialization perspective by the marketing researchers (Gupta et al., 2016) which refers to how an organization is able to effectively use the resources to develop a competitive advantage (Gupta et al., 2016). For an idea derived from MI to be successful, it depends greatly on how it works with the environment the organization operates in (Gupta et al., 2016). For emerging markets, the competition is constantly growing (Akhmetshin, 2019) and hence MI would greatly assist in creating a differentiated advantage for the SMEs in the market if implemented correctly.

SMEs are said to have marketing focused on areas that would evolve around new packages, designs, promotion methods and even pricing tactics and innovative and/or new distribution networks (Quaye & Mensah, 2019). The competitive advantage theory states that MI used to market a product to the consumers is key for firms (Gupta et al., 2016). Research conducted states that MI would support SMEs to overcome barriers and uplift their advantages in the market (Quaye & Mensah, 2019). Regardless of whether a SME has the capability to change their offering product/service they could use their resources integrated to develop MI that would assist in sustaining any market advantage (Quaye & Mensah, 2019) allowing for brand competitiveness.

2.4. Dynamic Capabilities Theory

The dynamic capabilities theory (DCT) identifies that a critical determinant of an organization competitiveness is determined by its marketing capabilities (Tan & Sousa, 2015). By using the DCT the study understands that BV, MI would impact BC. This theory focuses on the relationships between marketing capabilities and competitive advantage. The use of this theory would enable to development of the framework in order to ensure sustainable competitiveness for the brand (Tan & Sousa, 2015). The DCT argues hat the competitiveness of the organization would be based on the deeply embedded capabilities of the organization (Hernández- Linares et al., 2021, Tan & Sousa, 2015). DCT is vital for SMEs as,

unlike large organizations,

SMEs would find it challenging to utilize their resources in the constantly changing markets (Hernández-Linares et al., 2021) and is, therefore, a vital part of an SME competitive strategy (Rashidirad & Salimian, 2020). The following framework incorporates the notions of the DCT theory.

2.5. Conceptual Framework and Hypotheses

The present study presents a conceptual framework that discusses how MI and BV integrated would enhance the BC. The conceptual framework has been developed based on prior research-based which identifies a relationship and impact between MI & BC (Gupta et al., 2016) and also between BV & BC (Gupta et al., 2020).

Figure 1: Conceptual Framework
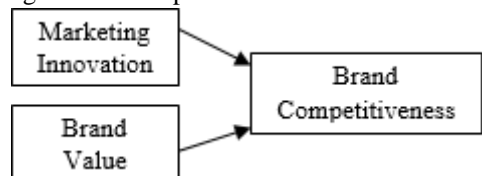
Based on the conceptual framework (Figure 1) above the variables brand competitiveness, brand value and marketing innovation has been hypothesized as follows:

H1: Marketing Innovation of the organization will be positively related to the Brand Competitiveness of the organization.

H2: Brand Value of the organization will be positively related to the Brand Competitiveness of the organization.

3. METHODS AND METHODOLOGY

This study explores how the integration of BV and MI helps to enhance the value of the BC of SMEs.

The findings comprise of the feedback received in relation to an SME player in the paint industry in an emerging market (Sri Lanka).

3.1. Data Collection

The present quantitative study utilized a survey research design that was conducted through the

use of a questionnaire that was distributed online. The sample population was based on the individuals who has previously purchased and consumed a product related to the selected industry among which a few consisted of those who had personally used products offered by the SME in concern. This questionnaire sampled the feedback of 103 respondents who each submitted their feedback based on their experience and exposure in the field of study (Table 1). Based on the feedback received from 103 respondents 49.5% were females while 50.5% belonged to the male population.

Table 1: Respondent Characteristics

Demographics	Frequency	Precent
Gender		
Female	51	49.5
Male	52	50.5
Age		
20–25 years	40	38.8
26 – 30	27	26.2
31 – 35	14	13.6
36 – 40	4	3.9
Above 40	18	17.5
Education Level		
High School	12	11.7
Undergraduate Level	34	33.0
Postgraduate and above	57	55.3
Level of Employment		
Junior Management	24	23.3
Executive	49	47.6
Top Management	8	7.8
Retired	8	7.8
Self Employed	14	13.6

3.2. **Measures**

The questionnaire employed the constructs of existing tested literature. Two variables namely, BV and MI were used to identify relationships with BC. Two measures were used to study BV; Emotional (BVE) and Rational (BVR). To study MI, measures approach to market (MIAM) and channel of communication (MICC) was used. Finally, BC was studied using two measures; Creation of Value (BCCV) and Creation of Demand (BCCD). The measures used have been displayed in Table 2 displayed below.

Table 2: Study constructs and scale items

Main Constructs	Measure	Authors
Marketing Innovation	Approach to market	(Luo & Tung, 2007)
	Channel of Communication	(Di Gregorio et al., 2009)
Brand Value	Emotional	(Gupta et al., 2008)
	Rational	(Štrach & Everett, 2006)
Brand Competitiveness	Creation of Value	(Amit & Zott, 2001)
	Creation of Demand	(Payne et al., 2008)

All responses related to the measures were recorded using a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). All recorded feedback was then subjected to a comprehensive analysis to help understand any relationship between the variable selected brand value and marketing innovation with brand competitiveness. All measures displayed a Cronbach Alpha value of greater than 0.70 and thereby confirming reliability.

4. DATA ANALYSIS AND PRESENTATION

The variables of the study concluded to have a positively skewed distribution of data as depicted from the normality test conducted to test the variables. The mean, mode and

median values depicted graphically allowed to the conclusion othe same (Appendix A) and the normality curves for each variable have been displayed in Creation of Value (BCCV) and Creation of Demand (BCCD). The measures used have been displayed in Table 2 displayed below.Appendix B, C, and D. Cronbach' Alpha of all the measures used for the variables was higher than 0.7 thereby demonstrating adequate suitability for the research purposes (Table 3).

Table 3: Factor Reliability

Main Constructs	Measure	Cronbach's Alpha
Marketing Innovation	Approach to market	0.745
	Channel of Communication	0.709
Brand Value	Emotional	0.781
	Rational	0.716
Brand Competitiveness	Creation of Value	0.723
	Creation of Demand	0.723

The authors also estimated discriminant validity to further ensure the adequacy of the measures. As all the Average Variance Extracted (AVE) values were higher than the threshold value of 0.5, convergent validity was supported (Hair et al., 2014). Discriminant validity was further evaluated by comparing the square root of the AVE of each construct with the bivariate correlations among constructs (Table 4). Composite Reliability (CR) values were higher than 0.7, therefore, construct reliability was further supported.

Table 4: Discriminate and convergent Validity

	CR	AVE	MI	BV	BS
MI	0.895	0.682	**0.826ᵃ**		
BV	0.914	0.728	0.248ᵇ	**0.853ᵃ**	
BS	0.901	0.652	0.372	0.365	**0.937ᵃ**

a square root of AVE in the diagonal

b Pearson correlations among constructs

4.1. **Hypothesis testing**

To estimate the fitness of the model estimates including the χ^2 statistic, the goodness of fit index (GFI), root mean square error of approximation (RMSEA), comparative fit index (CFI) and Standardized Root Mean Squared Residual (SRMR) were assessed using AMOS and SPSS. The model yielded acceptable fit indices: χ^2 /df = 2.504, GFI = 0.945, RMSEA = 0.032, CFI = 0.957, and SRMR =0. 0394.

The stated hypotheses were tested by using the correlation analysis (Pearson) which concluded that a significant relationship is apparent between the independent and dependent variables (Table 5). The correlation between BC and MI was .247 and BC and BV displayed a correlation of .482 thereby displaying a positive weak relationship. Therefore, the hypothesized relationships between BC and MI (H1) and BC and BV (H2) is accepted due to the displayed significant relationships of 0.012 between BC and MI and 0.000 between BC and BV.

Table 5: Correlation Analysis

Correlations		BV	MI	BC
BV	Pearson Correlation	1	.513**	.482**
	Sig. (2-tailed)		.000	.000
	N	103	103	103
MI	Pearson Correlation	.513**	1	.247*
	Sig. (2-tailed)	.000		.012
	N	103	103	103
BC	Pearson Correlation	.482**	.247*	1
	Sig. (2-tailed)	.000	.012	
	N	103	103	103

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

The study conducted displayed that the relationship between the use of the brand and the choice of brand displayed a value of 0.708 and hence does not display a significant relationship

5. DISCUSSION AND CONCLUSION

5.1. Discussion

This study examines the relationship between BV and MI with BC for SMEs in emerging markets. Therefore, the study emphasizes that based on the findings, a relationship could be established between BV, MI and BC. In addition, the results are aligned with the studies conducted by authors Gupta et al. (2016, 2020). The current study argues that BV and MI would contribute to the BC of SMEs which is a vital factor for these organizations that are operating in highly competitive environments. The study aimed at understanding if BV and MI influenced BC which has been proven to be true, while also understanding if BC would affect the perception of customers, which could be predicted as true as based on the competitiveness of the brand the customers could make the decisions regardless of the brand they may currently use. As limited literature is available in understanding the relationships between BC, MI and BV the current study would contribute to filling this gap. Therefore, also providing knowledge for the SMEs in emerging markets to align their marketing strategies to address BV and MI to guarantee BC.

Further, this study extends the generalizability of previous studies conducted to understand the influencing factors contributing to brand competitiveness of SMEs. Sri Lanka as an emerging economy in the South Asian Region (Dissanayake et al., 2016) was selected to conduct the study with the intention of testing and validating the developed hypotheses. Where the focus was on understanding how the customers in Sri Lanka and their perceptions on BV and MI impacted the BC of SMEs.

This study provides interesting insights in to how the DCT would contribute to build BC with the use of effective marketing capabilities through MI and building BV. SMEs in emerging countries primarily achieve their competitiveness through innovation, and branding strategies are embraced to help these SMEs to create marketing visibility (Mudalige, 2015).

It is understood that SME and economic growth in emerging countries have positive relationships (Mudalige, 2015), therefore with the given emergent nature of the current research area, this study would be one of the few to empirically examine how MI and BV contributes in refining BC and in turn encouraging success for the SMEs. Therefore, the study contributes to the conceptual understanding of BC through the application of the DCT for SMEs in emerging countries.

The limitations of the study can be identified as that this study collected data only from a selected industry of SMEs in one emerging market and hence the findings would be biased towards one market. The study also only considered the variables BV and MI while there would also be other variables that would significantly contribute to BC. Finally, the study collected data by distributing a questionnaire and hence an in-depth analysis would have been possible had a mixed research approach been employed.

5.2. Conclusion

This study interrogates the relationship between BV and BC as well as MI and BC for SMEs. The methodology of the study was centered on the employment of a questionnaire owing to time and situational constraints. The tested model was prepared based on prior studies conducted by authors who have tested how BC would be affected by BV and MI in order to understand the importance of BC and affecting factors for the SMEs in competitive markets. A relationship was then identified between BC and BV as well as between BC and MI.

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Use of IoT for Smart Greenhouse

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ABSTRACT

To maintain an adequate flow of food supplies it is required to maintain sustainable agriculture for the benefit of the future of the world. The world population is growing rapidly whereas the usable land area is gradually declining along with the rapid changes in climate as a side impact of these rapid changes happening in the world. Particularly, to the world context the same concerns are hindering in the Sri Lankan domain as well. For all these prevailing issues, the greenhouse is a sustainable solution that is also viable to counter the future food supply-related crises. The greenhouse can successfully combat the harsh conditions in the natural environment and is vital to cultivate throughout the year irrespective of the seasonal differences. Anyway, there are many limitations and challenges faced by farmers as well as the researchers in manually maintaining them. Certainly, the Internet of things as an evolving technology can contribute to this greenhouse-based agriculture and farming with the intervention of automation. This paper aims to analyze and understand the vital and viable mechanisms to use within the Sri Lankan domain by reviewing the recently available IoT- based applications in the world context to develop the most viable application.

Keywords: Internet of things, Agriculture, smart agriculture, smart farming, control systems, automation, greenhouse, remote monitoring, wireless communication, business

1. INTRODUCTION

Agricultural land area throughout the world is declining annually due to the increasing population, industrialization, climate change and the spread of environmental pollution. So, a drastic shift is required to make in order to prevent the ecological supply of foods by advancing the agricultural mechanisms. Greenhouse farming is seen as one of the better alternative approaches for food security and count as a sustainable socio- ecological approach. If we pay attention to the worldwide context currently, most of the things are controlled or operated through the automation, but in Sri Lanka this kind of mechanisms are not yet being used in fields like agriculture due to various reasons like cost issues. In Sri Lanka, agriculture prevailed from ancient civilizations. So, most of the people have only adopt the manual mechanisms of cultivating and they are not used to adopt technological stuff into to a field like agriculture. Greenhouses are very important in farming and agriculture sector. Under optimum environmental conditions, plants are used to cultivate within them. This is something made up of full transparent materials including walls and roof. As the world is developing and implementing new technology people world agriculture and farming have adopt sophisticated technologies these aspects of agriculture as well.

2. OVERVIEW OF IOT BASED SMART GREENHOUSE

2.1. Internet of Things (IoT) and Wireless Sensor Networks (WSN)

The Internet of Things can be defined as connecting daily objects, such as Smartphones, Internet TVs, sensors, and internet actuators. The smart greenhouse is a revolution in agriculture, creating a self-regulating, microclimate suitable for plant growth through the use of sensors, actuators, and monitoring and control systems that optimize growth conditions and automate the growing process.
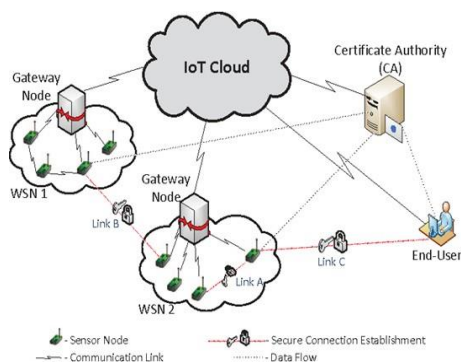

Figure 1.WSN Of IoT (Pawani Porambage, 2014)

In addition, with physical and internal security this smart greenhouse is securely built. In the operational, technological and consumer markets, IoT provides a transformation model. Trust and protection are required when changing the pattern in order to deal with different kinds of threats, problems, malfunctions and disastrous social effects. He is the producer of IoT securing products and the companies that use devices. In the event that the risk is organized, and all security issues are resolved in IoT, a complete collection of safety data is needed. Several IoT security needs including encryption, digital certificates and other safe communications have been suggested in this project.

Wireless sensor network (WSN) technologies figure 1. have grown rapidly over the years. Using outstanding instruments called sensor

nodes, environmental phenomena are monitored in a wide range. A number of sensors, processors and RF modules are supplied with battery operated WSN Bluetooth and Wi-Fi networking. A connection allows the communication of sensor nodes.

Wirelessly and forward their communication gateway to the database station or coordinator. The contact between sensor nodes depends on the different sensors being combined. WSNs were used for a range of purposes, including military, agriculture, sports, medical and industrial applications. Agriculture can be regarded as one of the most beneficial WSN facilities in raising the yields of food crops and reducing the pressure on farmers. Agricultural WSN is used to improve as cost- returns.

2.2. IoT and Cloud Services for Smart Greenhouses

By offering third-party network connectivity, IoT provides public cloud services to the IoT region conveniently. IoT data or computer components that operate with IoT products will also be helped by integration. When considering scalability requirement, IoT devices required a high storage capacity to store and share the respective information. IoT should provide clients with more space that can expand according to the customer requirements. Greater performance scale should be there to process the information or data collected through different fields. Performance Increased. Cloud IoT provides the communication needed to share system information Internet Cloud Computing infrastructures help IoT to provide more information. Consumers do not need to purchase more or less storage. (McKenna, 2021) By increasing the amount of data produced by Internet Cloud Computing and paying for its storage, they can easily scale up the storage. In basic terms, cloud computing means getting access to data and services, which can be ordered and accessed on demand, from a centralized pool of computing resources. Cloud implementations are commonly defined as public, private or hybrid in three separate model models.

Private cloud services are a secure cloud which is accessible only to a specific organization. A

private cloud framework provides additional

protection for any entity, including business, that needs to store and process private data or perform delicate tasks.

The Public Cloud Platform is like a private cloud, except the main distinction is that resources can be exchanged with other organizations, used to process and store the data, and the data can be transmitted over a public network like the Internet. Third-party providers offer Internet cloud services and are typically paid for the appropriate CPU, storage or bandwidth.

The Hybrid Cloud is a cloud-based computing facility utilizing a mix of private, in-build cloud and third-party public cloud resources. Instead of a typically packaged public cloud platform through the hybrid cloud model IT policymakers can handle both private and private elements.

2.3. **IoT for Smart Greenhouse**

Agriculture must also be an important objective; in smart agriculture, IOT plays a key role. Simply, smart greenhouse can be called as a self-regulating, climate created for growth of plants with the use of different types of actuators, sensors this monitoring and controlling of environmental conditions yields to growth optimization and automation of plants. In the IOT-based intelligent greenhouse farming system, sensors can be used to monitor required parameters like light intensity, humidity condition, prevailing temperature, condition of soil moisture.etc. and the irrigation system are installed to crop field monitoring. Farmers can check their field conditions from any corner of the world whenever they have time. In comparison with conventional approaches, IOT – based smart greenhouse farming is very efficient. Greenhouse agriculture is a method which improves vegetables, fruit, crops, etc.

3. Major RESEARCH IN IOT BASED SMART GREENHOUSE

In particular, IoT-based smart greenhouse was proposed by Ravi Kishore Kodali, Vishal Jain and Sumit Karagwal to increase current farming practices through the use of modern technologies for improved yield[Kodali, V. J. (2016)]. This study offers the model of a smart greenhouse, which allows farmers automatically perform their business in a farm without much manual inspection. A closed structural greenhouse

protects the plants of wind, hailstorm, UV radiation and insect and pest assaults from the harsh weather. Automatic dry irrigation, which works according to the threshold of soil humidity, in line with the need that plants get an ideal amount of water, irrigates the farm field. The Greenhouse monitoring and management of Android's Mobile Application has been suggested by Aji Hanggoro, Rizki Reynaldo, Mahesa Adhitya Putra. The monitoring and control of Green House is a whole system intended for inside a greenhouse to monitor and regulate humidity[Hanggoro, R. R. (2017)]. This program utilizes a mobile Android phone, which is connected by Wi-Fi to a central server that links a microcontroller and a moisture sensor through serial connection. The result demonstrates that the condition is in the data sheet and system of the sensor are in reality adequate. The achieved test result concludes that the system is working properly. Yung Sheng Chang, Yi Hsiung Chen, Sheng Kai Zhou suggested a clever lighting system for greenhouses based on narrowband- IoT connectivity, the promotion and popularity of communications technologies and the Internet. [Chang, Y. H. (2018)]. IoT applies in our daily lives to several applications, including medical attention, intelligent home, Greenhouse, smart cities and environmental monitoring. Three short range communication technologies – Bluetooth, Wi-Fi and ZigBee – are extensively employed in IoT, together with small drive ranges, average power consumption and weakness of the interference. Therefore, the low power wide area network (LPWAN) for cellular networks is proposed in the context of extensive coverage, reduced consumption and huge devices with reliable communication for IoT equipment. Have designed a greenhouse environment control and monitoring system consisting of the local and central stations by Ibrahim and Munaf [Al-D(2012)]. Local stations are utilized for the measurement of parameters and controlling of actuators, and a PIC microcontroller is installed at each local station that receives the data and delivers to the central station and receives the control signal needed for actuator operation. IEEE Global Humanitarian Technology Conference (GHTC) [2017] "For precision agriculture in Brazil utilizing remote monitoring systems." by Filev Maia Rodrigo . Have discussed an IoT device which is used to monitor

various agricultural parameters[Maia R. (2017)]. A sensor network is used to measure soil temperature, humidity, humidity and so on. In São Paulo, Brazil, the test was conducted. Different judgments on crop life and its sustainability have been supported by reference climatic data.

4. ADVANTAGES OF IOT BASED SMART GREENHOUSES

System Measurability and Straightforward Extension. - It is even more advantageous to have a wireless network in. Because of new or changed requirements, network expansion is important. The extension of the cable is tired.

Reduced Installation Costs - Since no cable is important, the installation prices are reduced considerably, first and foremost. Wired cable solutions must be cabled everywhere, because cables are highly expensive, wherever they are.

Mobility is there. The relevant circuits can be carried out anywhere anytime.

Due to the automation, there is a reduction in use of human labor as well. Embedded cost servers can be used in order to reduce the costs as well this would cutdown the unnecessary costs over purchasing very costly real web server.

Since the internet-based communication platforms are very scalable and flexible in using as per the requirements the everything like sensors and actuators are feasible to connect to a global scale network.

5. CURRENT ISSUES OF IOT BASED SMART GREENHOUSES

Controlling Issues – since most of the systems have been designed in order to monitor just one parameter at a time in order to monitor few parameters simultaneously few systems like that would be required. As most of the armers of developing countries they are not used to advanced techniques and technologies in their fields.

Energy consumption is very high in intelligent greenhouse systems if people are not there. This can waste enormous amounts of energy, as it cannot stop right away.

Technical Issues - The smartness of the

domestic automation systems based on IOT is also a big challenge. A safe auto-configuration approach should therefore be studied to implement the smart Greenhouse successfully. In order to improve this smart Greenhouse efficiently and effectively, more technical support is needed.

Other Issues – Cost that have to measure over the technical implementations may not be bearable for farmers of developing countries. Secured data transmission and storing is also a major requirement whereas technical threats can be arising.

6. FUTURE DIRECTIONS AND CONCLUSION

IOT is an integrated technology in modern society that can be used in many different areas of society. The architecture of smart greenhouse IOT systems is presented in this paper. The challenges and issues of IOT-based intelligent greenhouse are also clearly discussed in this study paper. This can be done through the use of the latest technologies and especially using the combination of IOTs. There are some serious problems. The IOT-based, intelligent Greenhouse automation can be improved with new technologies and methodologies. If they are all combined, and the customer base is clear about the intelligent greenhouse technology. Given below is a summary of future perspectives in empowering smart greenhouses with IoT.

- Integration of blockchain related technologies for the security purposes of data storing and transmission

- Research on soil condition monitoring, plant growth monitoring, plant quality monitoring, monitoring chemical composition of plants after fertilizing, and get use of prevailing local climate around the planation if applicable can be seen as some of major directions to create a solution on lower cost with reliability

- Coordinate industry giants in creating a protocol for data transmission which is unified that enables inter-operation standards and enhance the generalization of data annotation standards which facilitates visualizing and decisioning.

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Provide Equal Access to Justice and Enhance Legal Awareness Through the Use of ICT

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ABSTRACT

Access to justice is a fundamental human right that protects individuals from violating their rights. According to recent statistics, a significant number of Sri Lankans have been unable to obtain legal assistance and have given up on resolving their legal issues. The literature claims that this incident happens mainly due to a lack of legal education and limited access to legal resources. Such inefficiencies could cause inconveniences and incur unnecessary costs to citizens. Also, in most developing countries, there is a significant gap between citizens and the judiciary system. However, countries in the western hemisphere use multi-dimensional approaches to embed legal awareness into their daily lives. Thus, this study aims to introduce an Information and Communication Technology (ICT) platform to provide equal access to justice and increase legal awareness among Sri Lankan citizens. Data was gathered by using a survey, which is based on the Technology Acceptance Model (TAM), and semi-structured interviews. This research is largely exploratory, and data analysis was carried out using an open engagement strategy to determine the user requirements for the proposed ICT-based platform.

Keywords - Law, Legal awareness, Legal literacy, Sri Lankan citizens, TAM based analysis

1. INTRODUCTION

One of the most important things about living in a country is awareness and understanding of the legal system and the laws and regulations in place. However, that understanding is considerably lower among the Sri Lankan general public. It may cause inconveniences and unnecessary costs to citizens. Also, people sometimes tend to use illegal ways because they do not have enough legal knowledge to handle such situations. Out of Sri Lankan citizens who experienced a legal problem, only 19% could access legal help, and 8% had given up any action to resolve it. (Access to Justice | World Justice Project, n.d.) One reason for that is the lack of legal education.

Internationally, this is manifested as the 16th Sustainable Development Goal in the United Nation's 2030 Agenda. The 16th Goal is "Peace, Justice, and Strong Institutions". It is "dedicated to the promotion of peaceful and inclusive societies for sustainable development, the provision of access to justice for all, and building effective, accountable institutions at all levels." (Goal 16 | Department of Economic and Social Affairs, n.d.) It highlights that "the rule of law and development have a significant interrelation and are mutually reinforcing, making it essential for sustainable development at the national and international level." (Goal 16

| Department of Economic and Social Affairs, n.d.) Sri Lanka needs to improve the existing justice system, resources, and human factor to align with that.

1.1 Rationale

There is no proper mechanism in secondary schools in Sri Lanka to educate students about laws because it is not part of the existing curriculum. However, it is essential to cultivate the correct values and self-discipline in children from an early age. Most developed American and European countries have already included the law into the school curriculum and are trying to enhance the legal awareness of citizens in various ways. Even though those countries show a high awareness among ordinary citizens (Access to Justice | World Justice Project, n.d.), separate government and non-government organisations still promote and enhance legal awareness. Furthermore, there are several kinds of research carried out regarding legal awareness. Even though that research identified that this is a critical issue, they did not suggest or introduce a proper ICT-based solution to address this issue. Since computer literacy is rapidly increasing in Sri Lanka, finding an ICT-based solution to address those issues would be more valuable.

1.2. Research Question & Objectives

1.2.1. Research Question

How to improve access to justice and legal awareness through ICT interventions?

1.2.2. Research Objectives

1. To investigate how the general public accesses the current legal system.

2. To identify the challenges faced by the general public when accessing the judiciary system in Sri Lanka.

3. To ascertain the acceptance of technological solutions.

2. LITERATURE REVIEW

2.1. Legal Awareness

Previous research identified that the most common legal problems concern family, land, employment, community, and neighbourhood issues. Some of these issues come from day-to-day life and are experienced daily by many people. This can also create social difficulties. Legal problems are not limited to a particular category of citizens. However, they often affect certain groups of people more than others, such as women, children, and disabled persons. (Hyeon & Kim, 2016) Whereas individuals face specific legal issues, businesses also face different issues than individuals. For businesses, most problems are related to regulations, taxes, employees, payments, settlements, services and debt. Some of these issues are especially difficult for small and medium sized enterprises (SMEs).

Some impediments to accessing legal services are cost, time, complexity, and lack of legal knowledge and capability. Therefore, only a handful of people decide to take legal action, while others give up without even trying. As a result, the proportion of unresolved problems is still high in most developing and least developed countries. (Yasmin, 2012).
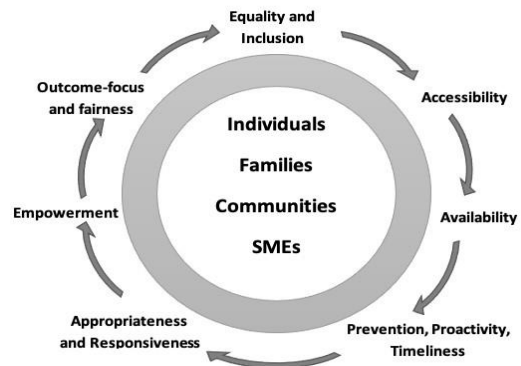

Figure 1. Design Criteria for people-centered legal and justice service
(OECD, 2019a)

Some research on legal needs identified several significant concerns based on people's evidence and experiences. Those studies emphasise that those looking for legal aid are more likely to

prefer a people-centred justice system and legal service.

2.2. Public Legal Education

As per some studies, Public Legal Education (PLE) is an emerging concept that has increased public awareness of the law by using various innovative methods that are easy to understand for most people. It is also called by different names in certain countries, such as in Australia as "Community Legal Education", in New Zealand as "Law Related Education", and in several other countries as "Public Legal Information". (Developing Capable Citizens: The Role of Public Legal Education The Report of the PLEAS Task Force, 2007)

According to the Public Legal Education and Support Task Force of the UK (2007) report, "PLE provides people with awareness, knowledge, and understanding of rights and legal issues, together with the confidence and skills they need to deal with disputes and gain access to justice." (Developing Capable Citizens: The Role of Public Legal Education The Report of the PLEAS Task Force, 2007) Although this is not the right answer to improving legal awareness, it can provide legal knowledge to address daily legal issues.

2.3. Dimensions of Access to Justice and Legal Needs

Several studies indicate the importance of using a multidimensional approach to understand legal needs and access to justice. It goes beyond the formal process and into an informal dispute settlement. These studies revealed that access to justice should have at least seven or more distinct dimensions, which are: content of the law; availability of formal and informal institutions to ensure justice; quality of formal and informal judicial institutions; availability of legal aid; quality of legal aid services; quality of outcomes; and legal capability (OECD, 2019b).

2.4. Citizens' Attitudes Toward Legal Compliance

There is a study which was mainly performed utilising the structural equation model approach with the data gathered from the 2012 Cooperative Congressional Election Study (CCES). The results of that study identified that the citizens' perceptions of the legitimacy of legal institutions, justice system scandals, and social capital considerations could impact citizens' beliefs on the importance of obeying the law. It explainshow the perceived legitimacy of legal institutions may affect a citizen's commitment to following the law. (Cann & Yates, 2020)

A direct influence can be observed, especially in different age categories where individuals under 40 show a lower level of obedience than those in the 40–60 age group (by about 0.4 standard deviations). In contrast, individuals over 60 years of age have a comparatively higher level of obedience (by nearly 0.3 standard deviations) than their middle-aged counterparts. When observing the hypothesise aspects, it can be identified that lower-income individuals may have fewer pro-obedience attitudes in the income category ($40,000 – $100,000 household income). However, individuals in the highest income levels (over $100,000 per year) scored about one-third of a standard deviation lower on the obedience index than their middle-income counterparts (Cann & Yates, 2020).

The study mentioned above observed that other variables such as college, race, jury service, and gender have no significant direct influence on legitimacy at the conventional $p < 0.05$ level, which is a (two-tailed) standard. The results based on this study show that men score comparatively lower obedience index levels than women. Also, college degree holders have higher pro-obedience beliefs than those without college degrees, as they have an indirect effect on the importance of obeying the law. (Bangani, 2018)

As technology is rapidly growing, social boundaries are also changing at a higher rate; hence, citizens' commitment to following established laws is gradually gaining prominence towards legal compliance.

2.5. Legal Needs Surveys

Most of the time, investigations of legal needs focus on the experiences of individuals with legal problems while legal institute & organisations play a significant role in their resolution. Surveys of legal needs identify real issues that people face and how they face them. Although both individuals & businesses are facing legal problems, most legal needs surveys focused on personal experiences, while only a handful of business-focused surveys were conducted. Most of these investigations of legal needs involve civil rights, such as administration, family, land, rather than criminal law. However, some specialised studies were carried out to investigate criminal law experiments. The most popular survey on legal needs is the World Justice Project survey conducted annually in more than 100 countries (Hyeon & Kim, 2016).

2.6. Role of ICT in Legal Services

Previous research indicates that most countries do not have enough resources and capacity to provide sufficient information on legal rights and services. Only a few countries offer ICT-based capacity building initiatives such as judicial websites, training staff on how to involve citizens in judicial services, etc. (Laptev & Fedin, 2020).

Moreover, in many countries, information on legal rights and judicial services is less accessible. In these countries, legal aid institutions provide legal support services through television and radio programs as a non-formal legal education method.

Another identified issue is that people living in rural areas are often unable to access the necessary legal services. They also noted that the high penetration of mobile devices could be used as a valuable way to enhance access to justice and awareness of the law. Several mobile apps have already been created to access their constitutions in developing countries like Ghana, India, Kenya, Nigeria, and Zimbabwe.

Although these apps have limited functionality, they can be improved further. (Durojaye et al., 2020).

2.7. Technology Acceptance Model (TAM)

Davis (1989) proposed the Technology Acceptance Model (TAM), and it has two constructs, which are perceived ease of use (PEOU) and perceived usefulness (PU), and these constructs determine a user's attitude towards using an ICT-based legal support system, which influences the behavioural intention to use it. Perceived usefulness (PU) is defined as the user's perception of the degree to which using the system will enhance his or her legal awareness, while perceived ease of use (PEOU) refers to the user's perception of the amount of effort needed to use the system, which would be both physical and mental effort.

The main survey of this study has been composed by utilising the Technology Acceptance Model (TAM) model, which facilitated understanding the relationship between humans and technology through Perceived Usefulness (the intention to use) and Perceived Ease of Use (computer self-efficacy). TAM further elaborates on the disparity between usage intentions and behaviours with a variety of IT-based technologies. The gap between legal awareness and justice can be influenced by manipulating the determinants of IT adoption and use. Here, the TAM works on the determinants of Perceived Usefulness and Perceived Ease by developing a comprehensive integrated model, testing the proposed integrated model, and presenting a research agenda focused on potential pre-and post-implementation interventions that can enhance legal awareness through IT interventions.

3. METHODOLOGY

3.1. Research Design

This study follows a mixed approach using quantitative and qualitative techniques. Data was gathered using self-administered questionnaires and semi-structured interviews. A simple

random sampling technique is used as a statistical measurement based on the gender, age, social class, and educational level of general citizens.
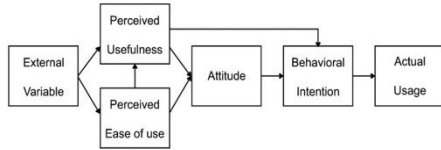

Figure 2. Technology Acceptance Model (Davis, 1989)

Data collection and analysis were carried out based on responses from members of the public and legal professionals. Face-to-face interviews are conducted with legal professionals. Surveys and focus group discussions were used to gather information from the public. The expected outcome is to propose an ICT-based solution to increase public legal awareness.

Furthermore, this research was conducted by following the Design Science Framework as follows.
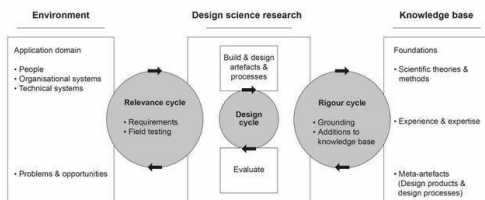

Figure 3. Design Science Framework (Hevner et al., 2004)

The relevance cycle incorporates contextual environmental criteria into analysis and places research objectives in the environmental field of study. It has been selected for thegeneral public and expertise in the legal field,and for analysis of the legal awareness throughout the community by using data collection methods such as surveys, interviews, and document review.

The Rigor Cycle incorporates foundational theories and techniques into domain experience. A comprehensive literature review has been done by following the previous research and identifying the facts that have been successes and failures. The design cycle encourages a more

closed loop of testing activity to develop and assess design artefacts and processes. Well-executed assessment processes must prove these artefacts in design evaluation. This artefact would be designed as an information system to enhance legal awareness among the community.

The research project's background connects with the practices of design science using the Relevance Cycle. The Rigor Cycle links design science practices to the research project's knowledge base of theoretical foundations, experience, and skills. The Research Design Cycle loops back and forth between the main tasks of creating and reviewing research design objects and procedures.

3.2. Data Collection Methods

As data collection tools, interviews, focus group discussions, and surveys have been used. All these tools are focused on capturing the users' preferences on technological platforms and the feature requirements of such platforms.

In semi-structured interviews, where the interviewer may not strictly adhere to the interview script. This data collection method clarifies what someone is saying deeply in terms of personal feelings, perceptions, and opinions about the topic.

Focus groups were made up of six to eight individuals who shared a common experience. It helped to ensure that all associates had an equal chance to participate in the discussion. So, it was possible to figure out what made them come for legal consultation and suggestions on an ICT-based solution to prevent those problems.

The total population of the survey is considered to be the whole country, which has an approximate population of 22 million people. The sample consists of385 individuals with a 95% confidence level and a 5% margin of error. Randomness governed the selection process, and each member of the population had an equal probability of selection. Therefore, the sample sufficiently represents the population. The survey is mainly composed by utilising the Technology Acceptance Model (TAM) to evaluate the users' acceptance of technology

based platforms. A few other questions were included to capture the design requirements of intended applications.

4. RESULTS AND FINDINGS

4.1. TAM Based Analysis

4.1.1. Perceived Ease of Use (PEOU)

Perceived ease of use defines the level of trust among individuals who use new systems and technologies free from difficulties. In this study, it is found that the majority the individuals have a positive effect on access to legal awareness through ICT interventions. An increase in ease of use leads to better performance ease of use, which will directly affect perceived usefulness and attitude towards using an ICT-based Legal Aid System. Cronbach's reliability coefficient for PEOU was 0.951.

4.1.2. Perceived Usefulness (PU)

Perceived usefulness is the degree to which an individual believes that using a particular system would enhance their legal awareness. As per the TAM model, perceived usefulness is influenced by perceived ease of use, since the easier the system is to use, the more useful it can be.

Perceived usefulness has a significant influence on attitudes toward and intentions to use an ICT-based Legal Aid System. The perceived usefulness of the system plays an important role in shaping the end-users' perception of using an ICT-based legal support system. Cronbach's reliability coefficient for PU was 0.868.

4.1.3. Attitude toward Using (AU)

An attitude toward using constructs is used in this research to measure the user's feelings or how an individual responds to using the ICT-based legal support system. In the TAM model, users' attitude towards using an information system is shown as a function of the constructs perceived usefulness (PU) and perceived ease of use (PEOU). The intention to use an ICT-based Legal Aid System is significantly influenced by

one's attitude toward using it.. Cronbach's reliability coefficient for AU was 0.984.

4.1.4. Intention to Use (IU)

As per TAM, a user's behaviour is determined by their intention to perform the behaviour. Intention to use a construct is defined as an individual's intention to use or commitment towards an ICT-based legal support system. Cronbach's reliability coefficient for IU was 0.849.

Table 1. Reliability Analysis Results

Scale	Mean	Std. Deviation	Cronbach's Alpha
Perceived ease of use			0.951
PE1	3.99	1.029	
PE2	4.02	0.955	
PE3	4.02	0.948	
PE4	4.00	0.964	
Perceived usefulness			0.868
PU1	4.02	1.001	
PU2	4.09	0.947	
PU3	4.06	0.871	
PU4	4.16	1.006	
Attitude towards using			0.984
AT1	4.06	0.903	
AT2	4.02	0.887	
AT3	4.06	0.896	
AT4	4.02	0.872	
Intention to use			0.849
IU1	4.01	0.984	
IU2	4.03	0.905	
IU3	3.95	0.895	

Since the Cronbach's Alpha is greater than 0.80 in all four scenarios, the questionnaire's internal consistency is good. So, it can be considered that there is high reliability in the questionnaire.

Hypothesis:

1. Perceived ease of use has a significant effect on the perceived usefulness of an ICT based Legal Aid System

Table 2. Hypotheses Testing Results (1)

Independent Variable	β	Std error of β	t	p	Notes

Perceived ease of use	0.758	0.033	20.450	<0.001	Accepted

2. Perceived ease of use has a significant effect on attitude towards using an ICT based Legal Aid System

3. Perceived usefulness has a significant effect on attitude towards using an ICT based Legal Aid System

Table 3. Hypotheses Testing Results (2)

Independent Variable	β	Std error of β	t	p	Notes
Perceived ease of use	0.735	0.037	19.082	<0.001	Accepted
Perceived usefulness	0.753	0.040	20.115	<0.001	Accepted

4. Perceived usefulness has a significant effect on the intention to use an ICT based Legal Aid System

5. Attitude towards using has a significant effect on the intention to use an ICT based Legal Aid System

Table 4. Hypothesis Testing Results (3)

Independent Variable	β	Std error of β	t	p	Notes
Perceived usefulness	0.873	0.028	31.473	<0.001	Accepted
Attitude towards using	0.864	0.027	30.199	<0.001	Accepted

Conceptual Model:
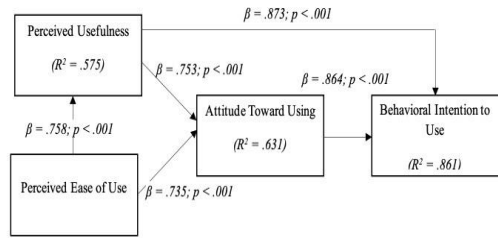
Figure 4. Updated Conceptual Model

The following functional and non-functional requirements were embedded into the proposed system based on the findings of the TAM and qualitative interview findings to enhance perceived usefulness and perceived ease of use.

Proposed Features:

- Self-Learning Area for citizens which is categorised according to age
- Categorised legal information which facilitates easily find required legal information
- Virtual Assistant, which facilitates AI-based natural language processing
- Speech recognition facility which enables easily search by speaking
- Connect with law experts
- Feedback facility
- Less number of steps

Figure 5. Interface of the proposed system

Proposed Non-functional requirements:

Usability, Reliability, Accuracy, Simplicity, Performance, Security, Conciseness, Privacy, Legal Compliance.

5. DISCUSSION

According to the conceptual model, it is identified that perceived ease of use (PEOU) and perceived usefulness (PU) have a significant effect on a user's attitude towards using an ICT-based legal support system, which influences the behavioural intention to use it.

Through the findings of this research, attitude towards using and perceived usefulness have a substantial impact on behavioural intention to use. However, even though all these have an influence, there is only 86% of the impact, and the remaining 14% will be based on other factors like experience, social norms, attitude, and risk-taking propensity. Also, the literature suggests that there can be various external factors affecting the remaining value.

As per the analysis, (H1) perceived ease of use has a significant effect (P<0.001) on the perceived usefulness. Therefore, the self-learning area for citizens, which is categorised according to age, has been added. Therefore, the literature suggestion of availability, timeliness, appropriateness, responsiveness, and effectiveness would also improve.

The study identified that (H2) perceived ease of use has a significant effect (P<0.001) on attitude towards using it. Therefore, the speech recognition feature, which enables easy search by speaking, has been added. Therefore, the literature suggestion of responsiveness would improve as well.

Also, (H3) perceived usefulness has a significant effect (P<0.001) on attitude towards using. Therefore, the feature of Virtual Assistant, which facilitates AI-based natural language processing, has been added. Therefore, the literature suggestion of timeliness and empowerment would improve as well.

Also, (H4) perceived usefulness has a significant effect (P<0.001) on intention to use. Therefore, the feature of speech recognition has been added. Therefore, the literature suggestion of responsiveness would improve as well.

Furthermore, (H5) attitude towards using has a significant effect (P<0.001) on intention to use. Therefore, the feature of speech recognition has

been added. So, the literature suggestion of empowerment and integration would improve as well.

In this research analysis, the findings demonstrated a positive signal that most end-users tend to accept and use this ICT-based legal support system. The findings were also consistent with the viewpoint of legal professionals.

6. CONCLUSIONS AND RECOMMENDATIONS

This study aims to provide equal access to justice and enhance legal awareness through ICT interventions. An ICT-based solution has been proposed to bridge the identified gaps by analysing the current legal system in Sri Lanka. The three identified research objectives could be successfully achieved with all the key findings and results analysed in this research.

The first objective, which was to investigate how the general public accesses the current legal system, identified how the community interacts with the existing justice system based on gender, age, social level, and educational level.

The second objective identifies to what extent the citizens are familiar with existing laws and the challenges, including difficulties faced by the citizens when accessing the judiciary system in Sri Lanka.

The third objective is to ascertain the acceptance of technological solutions. The results from end-users' demographic analysis illustrated a significant impact on end-users' intention to adopt and use ICT based systems.

Since the findings of this research suggest that the majority of the respondents are particularly interested in utilising an ICT based system, the proposed solution is likely to have a significant positive impact on legal awareness among Sri Lankans.

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Heterodox Leadership- A Subsequent Model of Leadership in the 21st Century

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ABSTRACT

Leadership has been the backbone of success for all organisations, and it spans over the entire spectrum of human existence. Contemporary times have seen leadership in its new avatar, especially with technology achieving new heights and Covid-19 pandemic causing loss to value human lives. Information overload is so high that it is difficult to identify the true leader. Every person is a leader in oneself and attempts to perform to one's capability. Everyone by now understands different leadership theories and traits associated with the brand called 'leader'. Schools and colleges teach leadership as a subject and everyone is familiar with the basics of leadership. However, leaders require different traits due to social changes, corporate demand, and various jobs, businesses, and entrepreneurship. This heterodoxic nature of leadership is taking shape with new ways of international trade and business as well. E-commerce and online trading platforms have multiplied manifold and have created enormous opportunities. Complexities of climate change, international relations and strategic power games are reshaping; there is, thus, rising demand for new types of leadership. The leadership models in the contemporary world are heterodoxic and freedom-oriented in the fast-changing technological milieu. Everyone has an opinion, and everyone wants to influence and expect others to follow. As a result, there are differences in views and teamwork and leadership are becoming challenging. Orthodox leadership in the future is likely to be based on both the latest technology and human resource. Leaders will have to transform to suit the dynamics of changing professional and social environments. This paper attempts to reflect on heterodox leadership in 21ˢᵗ century and how heterodox leaders will survive and sustain their excellence.

Keywords: Leadership, Heterodox, Heterodox leadership, Heterodox economics, New normal

1. INTRODUCTION

Leadership has always been the most discussed subject, especially in critical times of Covid -19 and the technology-oriented world. Everyone in the contemporary world understands different leadership theories and traits associated with the 'leader' brand. (Prentice, 2014). Schools and colleges teach leadership, and everyone is familiar with the basics of leadership. However, leaders require different traits due to social changes, growing corporate demands, dynamism in businesses and entrepreneurship. The western world has been teaching in the traditional method that has become a subject of discussion and contests with new-generation economy experts and new thoughts on real economy have impacted the market economy. Economics theories like the neo-classical and Keynesian economics models as taught in

Western countries have been outpaced by real economics in the world market. Contemporary times have seen a significant shift from regular economic activity to new international trade and business ways. Intranational relations and border management amongst the competing nations may witness difficulties, but economic relations remain enthralling. The case of China and Japan relations proves the point. E-commerce and online trading platforms have multiplied manifold and created tremendous opportunities. Complexities of climate change, international relations and strategic power games are reshaping; there is a subtle rising demand for different types of leadership. (Petricevic & Teece, 2019). The leadership models in vogue appear to be taking a new shape to be effective in the everchanging technological milieu. A peep into history conveys it all. Everyone has an opinion today and everyone wants to voice it and expects others to follow. As a result, differences in opinions make teamwork and leadership extremely challenging. (Porter & Reinhardt, 2007).

Leadership traits like bravery, intelligence, maturity, good administrative abilities were essential traits of leaders before the information age. A leader had to lead by personal example in war and peace. Today, the same king or a leader need not physically lead his army into battle, occupy territory or be the best in archery and riding. The contemporary environment is technology and digital-oriented; artificial intelligence and data analytics are part of everyday life. In such an era, emotional intelligence, social quotient has taken a back seat, and the virtual platform has become the primary platform for all leaders to lead. Today, they must excel online and offline, constantly connect with their followers, and age is no bar for becoming a successful leader. Expertise in technology and the use of virtual platforms are essential to being successful leaders. Strategic vision, economics and specialization play vital roles in deciding the accomplishments of the leaders in contemporary times. There is no single definition of the phrase *"Heterodox Leadership"* in any dictionary.

A search in the internet Google Scholar leads to definition phrases: team leadership, brand leadership, cost leadership, market leadership, price leadership, thought leadership, and many more. It also suggests the reader look for both the words, 'Heterodox' and 'Leadership' separately. Cambridge dictionary defines *'Heterodox'* as "beliefs, ideas, or activities different to and opposing generally accepted beliefs or standards. Example: His opinions have always been distinctly heterodox." (Cambridge). *'Leadership'* has been defined in the Cambridge dictionary as; "C1, the set of characteristics that make a good leader: What the company lacks is leadership. He lacks leadership qualities/skills, the position or fact of being the leader, the person or people in charge of an organization." (Cambridge). Ever-changing nature of human existence is a universal truth and changes in leadership styles are no different. What will be the nature of these changes is and how human lives are going to be impacted is the issue of deliberation to help humanity understand the broader meaning of social life and leadership. The need to revolutionize leadership thought in the contemporary world is the way to succeed. That is possible through a combination of traditional traits with a modern technological approach called Heterodox Leadership, a relatively new concept of leadership in the 21st century.

Orthodox leadership in the future will have to change to heterodox qualities to include both the latest technology and excellence in human resource management. Leadership skills will still be individual leader-based, but the leader will develop new qualities to foot the day's bill. This paper attempts to identify heterodox leadership and how heterodox leaders will excel in the contemporary world.

1. OBJECTIVES

Through this article, the paper's authors have visualized the need for a subsequent leadership model contextualizing decades to come in the 21st century. As the leadership models themselves are under transformation, subsequently emerging, developing a heterodox leadership model is a riposte of the juncture. Our goal is to forward a

theoretical and a conceptual model of leadership in light of the core connotation of heterodoxy as the interplay in creating the subsequent leadership model.

2. METHODOLOGY

For the concept and the model building, the researchers must begin by deciding a model to use in the context. Here, we proposed the model by developing the context by considering the 21st century's leadership. The existing leadership models will lose their relevance if we observe the present global leadership traits. The paper is based on qualitative and secondary sources based on research. On these backdrops, while proposing a subsequent model for leadership, we determined the model boundary by the conception and characteristics of heterodox as an umbrella concept. Under the idea, we tried to develop those relevant axes to map and build the model. This article's discussion and scope are restricted to knowing the heterodox leadership traits and mapping the heterodox leadership model based on the existing leadership practices.

3. HISTORICAL PERSPECTIVE OF LEADERSHIP STYLES

4.1. Indian Leaders and Empires

Leaders like Lord Ram, Laxman. Bharat, Lord Krishna, Yudhishthira, Arjun, Chanakya, Ashoka in the Indian historical context has had varied traits. However, some characteristics like bravery, resilience, maturity, empathy, visionary and many more are common and essential to being a leader. India is replete with examples from the Mauryan empire, Gupta period, Satvahana dynasty, Cholas and right up to the rise of Delhi Sultanate with outstanding leaders who have made a mark for themselves in Indian history (Sastri, 1964). Indian Gross Domestic Product (GDP) from 1st to 10st century AD was the highest globally (Bairoch, 1995). Credit goes to leaders, kings and wise men of the golden period. In 1025, Rajendra Chola extended the Indian empire and ruled over the Indian subcontinent and South-East Asia (Ronald Findlay and Kevin H, 2007). Leadership over the centuries has been pivotal to match the need of the environment. Traditional orthodox leadership where personal strength and power of leader were necessary to exhibit his dexterity over the rivals and the competitors have a different set of opponents and competitors in the contemporary world. The way kings and leaders fought wars and administered their states gave out certain traits essential for the rule. Military leaders dominated the kingdoms and empires. Alexander, Julius Caesar and Augustus in Europe were prominent leaders who were models for trait leadership. Kings like Ajatshatru, Chandragupta Maurya, Ashoka the Great and Chanakya were leaders with similar traits in the Indian context. They were leaders of yesteryears who succeeded in their times.

4.2. Traditional Leadership Traits

The leaders of yesteryears have been men of steel, will, gut and strength of strong personalities. They have been physically strong and mentally resolute. They became leaders and kings by hereditary or revolted against the ruling king and usurped power and established empires. Some of them were benevolent, while others were ruthless autocratic leaders. There have been religious, spiritual, social reformers, scientists, sportsmen leaders whom people followed due to their unique qualities. Kingship and military campaigns threw up leaders in the past based on circumstances and they took responsibilities for the survival, protection and growth of their countrymen. Based on their thought processes and behaviors, social scientists identified traits needed to be successful leaders. Trait theory describes these qualities as essential ingredients of a good leader. These traits differentiated leaders like General Zorawar Singh, Napoleon Bonaparte, Field Marshal Montgomery from others by a set of attributes that they were born with. The premise is that men born with special abilities can only become great leaders, which has seen the test of time (Stogdill, 2021). Great man theory exhibited that inherent natural traits like bravery and intellect are essential for a person to become a leader and great leaders are born with these superhuman qualities (Spector, 2015). *'Leaders are born and not made'* came from some genius leaders examined by Trait and Great Man Theories. It was land, resources and people

that were considered most important before the industrial revolution. The focus of humanity changed to the exploitation of fossil fuel during the industrial revolution. In the 20th century, oil was driving the economy and became the source of power. The second world witnessed nuclear science as the significant power that changed the course of world history.

4.3. **Progressive Need of Leadership Qualities**

An analysis of these traits over the last couple of centuries shows a changing pattern. In the 20th century, leaders exhibited different situational traits. (Technofunction, 2021). Psychologists observed that ordinary citizens could train and become good leaders. Lal Bahadur Shastri and APJ Abdul Kalam are some examples from India. Many ordinary men have similarly led large armies and won wars. All along, leaders developed capabilities to dominate land, people and resources continued to learn and change. Their abilities, characteristics and traits also changed to meet the challenges of the new world order. The Great Depression was another major event that shaped new types of world leaders who understood the role of the economy in the growth of civilization and focused on creating technology-based innovations. In the Indian context, the year 1991 was an important landmark when liberalization of the economy started and the Indian economy was never the same again. The change in traits of Indian leaders was visibly different from the past experiences. Agrarian economy, industrial age, technology and information revolution, and the internet were different phases of humanity when leadership styles and leaders continued to evolve and adapt to new ways of life.

A slow but sure change is visible in the leaders from personal physical power to social and technological capabilities. George Kelly propounded Personal Conduct Theory (PCT) and opined that cognition of a person makes his personality and interpreted those leaders have a similarity of personality constructs like intelligence, kindness and bipolarity explain person being ugly and stupid (Kelly, 1955). Contingency theory propounds that an effective leader in one situation may not be effective in another, and circumstances throw up new leaders (Fiedler, 1967). It appears that society and leaders have gone a step beyond contingency theory and leaders in their unique way are influencing the masses.

4. THE CHANGING LEADERSHIP TRENDS IN CONTEMPORARY WORLD

The strategic, economic and social world order in the contemporary world is changing faster than any previous world order. Power is being applied in different forms to exert a specific influence on the masses and people follow the leader in his particular field duly facilitated by digital technology. The leadership is shaping differently in the 21st century; democracies are preferred options of rule by the world at large and leaders too have adopted a democratic approach. The majority views and opinions comprise the collective decision for countries to form policies and constitutions. Every national leader or corporate CEO operates through a set of specified rules. Leaders who can take the efficacy to a higher level are likely to stay in power. Value-added services and security of food, water, climate, health, education and job have gained prominence. Any leader who can deliver better opportunities is preferred over the autocrats and harsh leaders. Interestingly, maturity, intelligence, social and emotional awareness are essential traits of the leaders needed today. Leaders in the industry have graduated from the best output views of Max Weber to the humanistic approach suggested by Peter F Drucker. The move is a deviation from a fixed best method to identifying the most effective means of work and work-life balance is a crucial ingredient of leadership. Innovation, entrepreneurship and strategizing the future with a focus on employee satisfaction have become the theme. Leadership is changing from transactional to transformational style with a required level of technology infusion.

5.1. **Case Study: Steve Job in Apple and NeXT**

In general, concern for employees, clients, and people is a leader's biggest concern for all organizations. Steve Jobs was a co-founder of Apple, left the company after ten years and started a new venture called NeXT. It was a tech company that specialized in the business and education sectors. Apple bought NeXT within a decade and invited Steve Jobs into the leadership role. Apple never looked back since then, and it was possible because of his excellence with entrepreneurship and innovative skills (Suggett, 2019). Apple has never been the same after Steve's death in 2011 and the company had to continue to learn and grow to retain its top position. This type of leadership may be considered a revolutionary departure from orthodox and may be renamed as 'heterodox leadership'. The CEO or a leader of any company, group or society has to be concerned with providing the best product to the people and at the same time look after employees in the most effective manner. The day he fails, his sales diminish, or his employees are unhappy, that will be his last day as a leader and as CEO. The leadership that used to last for the lifetime of a king has reduced to the time duration of effectiveness of a leader now; it is a hybrid of transformational and digital capabilities, and a leader survives till he reaches the point of marginal utility. The size of a soap bubble that spans about 26 seconds starts bursting due to increased surface tension' so is the case with 21ˢᵗ-century leaders.

5.2. Impact of Technological Innovations

Similarly, the life of a winner is till someone else starts winning (Drucker, 1998). The change is unavoidable, and civilization has to zrealize it, make suitable changes and continue to thrive. The last decade of ᵗʰ20ᵗʰ century saw giants like IBM and GM taking significant strides. In the 21ˢᵗ century, Google and Microsoft are creating ripples in the business world by sheer understanding that the role of leadership is crucial and is dynamic. The unfolding of the 21ˢᵗ century is beyond the average human perceptual arena and the role of leadership entails changing with an unparallel speed. Internet and technology in all fields have started dominating

human lives. 2G has now gone to 5G and better, faster and more effective means of business, social and personal aspects are springing up every day. Businesses and industries are E-commerce based; governments have made it mandatory to use web-based E-commerce platforms for every possible business transaction. The internet is the resource even if one has to travel for medical treatment or business or pleasure trips. Internet of Things (IoT) and big data are an integral part of all activities. Pandemic Covid-19 has added complexities; personal interaction during the pandemic became impossible as all institutes were closed; lockdown prevented social interaction and life came to a standstill in 2020 and 2021. It was technology that connected everyone to fight the pandemic and continue the progress. Everyone on the planet is concerned about the uncertain future of leadership and questions like, 'What next; who is next?'; are common. Transparency in personal and professional life has become a norm as there is nothing one can hide. The majority of personal, professional and social information is available on the internet; all that is needed is to type in the part input. Artificial intelligence, big data analysis and computer engineering tools have changed the outlook of information-based decisions matrices. Upgraded security measures have been innovated and installed to prevent leakage of information and fraud. Internet experts and hackers are playing the opposite roles. An undeclared war is out in the open. Who will win? Anybody's guess!

In such a scenario, leadership is leaning towards web-based virtual leadership; chivalry of the good old days is not applicable anymore. The threat is not from an adversary who would loot the territory, wealth and women; it is much more than that. Technology-based systems may destroy an entire estate with a click of the digital mouse. Leading through the web and technology is an art in itself. Leaders communicate and ensure follow-up actions on virtual platforms using technical expertise. Technology based contemporaneous feedback and improvements bring in excellence in the organization. Has the time come when 'Camera Focused Leadership'

will become the central focus of leadership? It is possible to trace a minor message on social media and complex surgical operations performed due to advancements in technology. Reaction or response remains elusive. Are these the signs of a new variety of leadership challenges? Unique challenges demand a unique leadership style, a non-orthodox style that will succeed in modern times.

5.3. **Techno-Based Leadership Challenges in Military Warfare: Case of Armenia and Azerbaijan War**

Complexities and learning are the new norms for leaders today. They have to ensure the resolution of issues and challenges online and hence have to master the art of technology. Application for technology in wars is vital. Applying ground forces and organizing them with plans to maneuver them for strategic victory has become obsolete. The recent case of war between Azerbaijan and Armenia in September 2020 reflects the change in future leadership. Armenia had convincingly defeated Azerbaijan in 1991-1994 in a conventional battle. Armenia had better quality and quantity of tanks, guns and radars that were deployed on the borders with Azerbaijan and were well poised to defeat any ground offensive from Azerbaijan. The geostrategic realities changed when the two countries went to war again in 2020. The tables were turned on Armenia. Armenia continued to use the same weaponry and ground forces and was assured of victory. On the contrary, Azerbaijan employed technology to emerge the victor. Azerbaijan employed drones to identify locations of Armenian weapon systems and destroyed them without employing any ground forces. The Armenian forces lost the war without a physical battle and suffered a humiliating defeat with the only option to accept defeat and surrender the region of Nagorno-Karabakh to Azerbaijan (Gupta, 2020). This battle was techno-heavy with complete transparency of the battlefield. No major military or political personalities made tall claims and no military leader was seen leading the charge on the battlefield. There has been no open exposition of victory by Azerbaijani or acceptance of defeat

by Armenian leaders. Does it point towards a new shift of style of leadership that is non-orthodox and non-traditional? Yes, it does. The authors define it as Heterodox leadership.

6. HETERODOX LEADERSHIP: A NOVEL CONCEPT IN 21ˢᵀ CENTURY

6.1. **Transformational Role of Leaders**

The contemporary world is a fast-changing one that is uniquely different from the past. The probability of leaders' success is based on their capability to adapt to the digital revolution, data analytics and artificial intelligence. Leaders need to creatively integrate themselves and their employees with the technology in a symbiotic relationship and ensure that they enjoy learning new ways of excelling through this revolution (business.com, 2021). The live example of Jack Dorsey, CEO of Twitter, one of the significant influencers and a leader in the contemporary world has exhibited traits of a modern leader who has a virtual empire, leads through technology and is rated as one of the most successful leaders. (Council, 2020).

The decade of 2010-2020 has seen four companies achieving a market capitalization of $1 trillion; Apple in 2018, Microsoft in April 2019, Google in January 22020 and Amazon in February 2020 (Beattie, 2020). This kind of rise of empires and leadership is unparallel in history. The same analogy applies to heads of the nations where professionalism as strategic, political and technological prowess are essential qualities for them to rise to power and retain it. Politically established leaders like Prime Minister Narendra Modi, President Putin and President Trump impact or change opinions designed on their social media campaigns. It all depends on how long one can keep the followers engaged, provide them with the necessary sources of sustainable livelihood, social structure for them to interact, express themselves and create a sense of bonding. When a fashion model or a movie star loses the connection, followers shift to the next best alternative. A leader need not be from blue blood or a wealthy family or not necessarily have had

international exposure, but he has to be excellent in his specific field and continue to serve his followers. He has to deliver the desired goods or services; he will likely retain a top leadership position. The present era has thrown up dynamic, non-orthodox and can lead by personal example through personal interaction and remote digital means. Trait theory possibly needs to add more characteristic qualities to be popular and effective with the masses.

6.2. Economic and Social Heterodox Leadership

6.2.1. Economic Heterodox Leadership

The solid economic sense in a leader has always been vital to his success. The contemporary economic concept and trade are transforming significantly, and a heterodox economy has been reviving in the USA and Europe for the past two decades. Leaders and their followers are both leaning towards the teleological approach as against deontological. "What is in it for me?" (WIIIFM) approach is the name of the game today. Every individual and organization focus on the outcome for every input, and revenues and profits are the primary concerns. Karma theory is a second priority to the extent that man today is no more believing in his deeds that will decide his future; instead, he selects that mode that gets him more material wealth (Silvestre, 2016). Similarly, modern thinkers opine that the Keynesian model of state economy providing opportunities and employment is inadequate and think they can perform better than the governments (Keynes, 1936). The new Keynesian model paves the way to more unique ways to manage the world economy (Lawson, 2006). Every individual today has a plethora of information and knows the likely outcome of their venture. Hence every relation, trade and action are goal oriented. Contingency theory in modern form may continue to throw up leaders to suit changing political, economic and social structures. Changing environment and managing overload of information with new technologies have to be considered in addition to leader-member relations, task structure and position power. Information is available in equal measure

with doctors, lawyers and strategists and all of them work out their options or future course of action. Alexa of Amazon, Siri of Apple and Google assistant, have all possible answers to the most complex situations. Game theory is now an old tool for decision-making as there are better means and technologies available at the click of a button on the computer.

6.2.2. Social Heterodox Leadership

In such an environment where technology aids inefficacy of leaders and robots can replace human intervention, are the leaders required? Young fashion models, social workers and influencers impact the minds of the masses in the same as leaders in the past, albeit in a different manner. Greta Thunberg, a Swedish student with autism at 17 years of age, spoke about climate change and she has become a leader in her sense when she says, *"No one is too small to make a difference"* (Kuhne, 2019). Televisions and the internet provide second to the second latest update of the world. Bollywood actress Kangna Ranaut became a sensation when her house was demolished, and the Bombay High Court stayed her petition against the Brihanmumbai Municipal Corporation (BMC) (Singh, 2019). Such cases have thrown up leaders who possess the power to change people's opinions for or against a democratically elected government. In such a dynamic scenario, traditional and orthodox leadership loses their much-established relevance. There is possibly a case for a new way of leadership based on technology and man-management abilities and call it *"Heterodox Leadership"*, where the latest and novel leadership model is the need of the hour. This new model may be a departure from the past and existing leadership traits and theories and has a new set of attributes that will sustain the leadership.

7. RESULTS, FINDINGS AND RECOMMENDATIONS

The world is transforming at an alarmingly non-orthodox and dynamic pace, primarily led by advancements in technology. As a result, the governance policies are adjusting to a new

environment, social life is fast adapting to new technology, and the education system has adopted digital norms. Online free and paid courses on all possible topics are available on the internet. Whether a leader or a child, the learning process has gone digital; everyone is on the net. The amount of time of the day spent by humans on the net is humongous. Traditional life has changed and is now dependent on technology and virtual connectivity. Even the remotest corners on the earth have internet connectivity. Internet-based communication and provision of aid during emergencies and disasters has become a new norm. The average time per person on social media worldwide in 2020 was 145 minutes per day. (Tankovska, 2021).

Moreover, it is only increasing by the day and hence a leader has to be adept and Master of Technology to influence people they want to impact. The industry uses technology for all aspects of business and strategic business decisions are taken based on the environmental inputs from the internet. Artificial intelligence, robotics, digital network and the internet of things are the arms that future leader has to be excellent. Victory in everyday undeclared war depends on the vision and strategy developed by these leaders through technology.

8. HETERODOX TECHNO-LEADERSHIP MODEL

The changing scenario and population requirement for survival and growth depend on combining two aspects of the human evolutionary process and emerging technology. Reptiles do not have emotions; mammals have feelings but they do not possess the brain and mind that human beings have. The need for community living by human beings and emotional content in their relationship makes life worth living. Evolution has brought technology into human life that has changed the entire perspective of leadership that is being coined as *Heterodox Leadership*. The rapid growth of technology and reshaping of leadership format has to integrate both

emotional and social content in human life with the technology. The amalgamation of the two is possibly the way ahead for future leadership. A working model created by the authors is given below.

Figure- 1- JSR Heterodox Leadership Model
Note: HTL stands for Heterodox Techno-Leader

The model explains heterodox leadership qualities of 21st-century leaders who are transactional and transformational on the X-axis and their personal and social attributes on the Y-axis. Both transactional and transformational types of leaders have to possess modern-day technological expertise. That is a fundamental requirement and anyone without these qualities is unlikely to become an effective leader.

Heterodox Techno-Transactional leaders with technical know-how are likely to promote themselves and establish a virtual empire for their personal goals. On the other hand, Heterodox Techno-Transformational leaders are likely to employ technology and their leadership qualities for the organization's good.

8.1. **Heterodox -Techno-Transactional (HTL1)** (Bottom left quarter)

Leaders are heterodox leaders who are self-oriented, care about personal growth and strive to lead an zorganization with a transactional approach. The primary requirement of all leaders is their expertise in digital technology. Armed with this knowledge, the leader makes use of technology for his gains. He helps only those who support him and at the appropriate time, he uses their info to side-line them. He creates a digital façade to create his followers and increase assets. He is not attached to anyone and focuses his energies on his career and goals. Self-goal seeking personality is unlikely to last long as others will find out his ulterior motives and he may lose the leadership status. His followership will comprise all those who benefit from him directly. Social cause is a minor concern of this type of heterodox techno-leader.

8.2. **Heterodox -Techno-Transformational (HTL 2)** (Bottom right quarter)

These are the Heterodox techno-leaders who have understood that technological knowledge is the way to success and hence have a learning attitude. Their focus remains personal, but they are ready to integrate personal growth with the company and grow with their environment in personal and professional lives. They are

personal-oriented team players and will prove to be excellent employees. They will develop their network for personal growth and career. Given a chance, they will lead the organization with an outstanding strategic direction to the company. Ideal image is much higher than the actual image of these leaders. Confrontation will arise when another leader comes up and the rival is as strong. He will take every possible technical support and adopt means to defeat the competition. Personal ambition based on technical proficiency is the key factor.

8.3. **Heterodox -Techno-Transactional (HTL 3)** (Top left quarter)

They are the Heterodox Techno-Transactional Leaders who are socially inclined with higher emotional connect with their 'sorganization and social circle. They work for the benefit of society and may even forgo their stakes and careers for the sake of followers, employees, and their environment. They are technically qualified to achieve the targets of the company. They are likely to train employees and subordinates for the betterment of the organization. They are the leaders who would delegate responsibility and automate routine decisions. They are excellent team members with limited personal goal orientation. Such leaders at times lose to HTL1 and HTL 2 leaders but are more satisfied and are preferred by their society and organizations they work with.

8.4. **Heterodox -Techno-Transactional (HLL 4)** (Top right quarter)

They are possibly the leaders with excellent traits of traditional orthodox leaders and adapt well to the new age technology. They are leaders who possess outstanding cognitive and professional technical skills. They are incredibly mature and understand human emotions and the impact of technology. They are likely to use their expertise for the good of their organization. They are open personalities both on virtual and real-life platforms. They are likely to lead a happy team with satisfied followers and clients. They are the ones that suit the 21st century the best.

9. LIMITATIONS AND SCOPE FOR FUTURE RESEARCH

Developing a robust theoretical model needs systematic testing. To derive a systematic inference from the test needs data and evidence. Here, the heterodoxic characteristics proposed are a conceptual model in the field of leadership and are being developed under a constraint. There are gaps due to proof-based testing and explanations, which offer an opportunity for empirical research. The authors plan to conduct complete-fledged research to alter this proposed model to a robust empirical-based model. Other researchers would also be able to contribute for refinement for exhaustive testing. There is ample scope for global testing of this model to shape the global leadership model in business, politics, social spheres of leadership practice. We predict the great possibility of heterodox leadership in the behavioural domain.

10. CONCLUSION

The change is visible in society today and the requirement of human survival and technical excellence are prime drivers of leadership. Leadership qualities since ancient times have undergone significant changes. The shift of leadership traits from personal physical strength, sword skills, riding and many more traditional skills are no more valid in contemporary times. The strategy revolved around capturing territories, killing/capturing kings, and overpowering people and assets of the pre and post zindustrialization phases are becoming extinct. It has evolved with the digital revolution and information-abundant environment. Strategy to achieve maximum technological supremacy is the foremost requirement of any leader. While nations have boundaries, heterodox leaders function in cross-cultural environments; people and technology across the globe are their assets. Heterodox leaders with outstanding skills of personal human and relational skills coupled with technical know-how are the ones who will be future leaders.

Wrapping up the discussion on the relevance of heterodoxy in leadership practice, this theoretical replica has been posited as the unique theory in leadership research. The present world understands that the 21st-century leadership theorem has to embrace many subsequent paradigms and heterodox as the leadership paradigm is one among many important. This heterodox in the leadership domain explains the contemporary paradigm as the crux traits, actions, and strategies to lead forward in an ongoing ambiguous time frame of this century.

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Living with COVID: Smart Blood Finder System

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ABSTRACT

In the end of December 2019, COVID 19 virus was found in Wuhan, Hubei Province, China. The virus has spread globally since its discovery. Like other countries, we are facing many challenges with COVID 19. The number of COVID 19 victims is increasing day by day. Today, there are about 32.0M reported cases of COVID worldwide (worldometers, 2020).

One of the major challenges is blood supply. Some COVID-19 patients need blood transfusion to recover from the virus. There are different types of blood, and some blood types are very rare. But the point is that the corona virus disrupts the blood supply chain. Due to the current situation, blood donation camps cannot be organized, and blood donors need to ensure their health. Even every blood packet needs to track here is currently not a computerized system in Sri Lanka to carry out that process. Everything is done manually but it is not good for the present situation, and it is not easy to manage. Also, it takes a lot of time and requires more people to work on that process.

We have developed a system called Blood Finder, which contains a simple Android app and a simple website. Using this system, hospitals and the Ministry of Health can easily manage blood donors throughout the island. The Android app is for donors and the website is for the Ministry of Health and hospitals. This system provides a superior experience to the users, and it has better functions compared to the existing manual system.

Keywords: Blood finder, Health, Blood donation

1. INTRODUCTION

Blood donation is the process of transferring blood from a healthy person to someone in need. Donor's donation of blood can save as many as 3 lives (Service, 2020). "Today's world is based on computers and new technologies. We have a lot of techniques to make easy our work and ignore the time-wasting of our work. And nowadays, "61.62% of peoples use smartphones in the world" (turner, 2021). But we use traditional systems yet. One example is our blood donation system. It runs manually. This traditional system has many drawbacks. In Current pandemic situation hospitals needs bloods to transfer to COVID-19 patients (American Red Cross, 2021) and all we can remember is April 21st Easter attack on Sri Lanka. On that day blood banks need a lot of blood and not enough blood reserve. In that case, hospitals request to members of the public to donate blood. So, they need to pass the blood request to the public. But it came to some difficulties because that day blocks all social media networks in Sri Lanka. And, blood is always needed for treatments of accident victims, cancer patients, hemophiliacs, and surgery patients. Because of these cases, blood banks need a good blood supply. In that case, they organize blood donations camps to fill their blood reserve. But it's not enough.

Figure 1. Current Pandemic Situation Blood Need Poster
Source: (Soysa, n.d.)

"Hospitalized COVID‑19 patients required many fewer blood transfusions than other hospitalized patients. COVID‑19 transfusion data will inform planning and preparation of blood resource utilization during the pandemic" (Christina M. Barriteau Patricia Bochey Paul F. Lindholm Karyn Hartman Ricardo Sumugod Glenn Ramsey, 2021). Talking about blood types there are some matching algorithms in blood types. Blood circles through our body and conveys necessary substances like oxygen and supplements to the body's cells. There are two main types of blood antigens.

1. ABO

2. Rh

It combines to create blood types: O+, O-, A+, A-, B+, B, AB+ & AB-

Table 1. Blood Types of Comparison

Blood Type	Can Give to	Receive From
O+	O+, A+, B+, AB+	O+, O-
O-	All blood types	O-
A+	A+, AB+	A+, A-, O+, O-
A-	A-, A+, AB-, AB+	A-, O-
B+	B+, AB+	B+, B-, O+, O-
B-	B-, B+, AB-, AB+	B-, O-
AB+	AB+	All blood types
AB-	AB-, AB+	AB-, A-, B-, O-

Some blood types are very rare. Table 1 shows that blood matching algorithm. As an example, some patients with Blood Group 'O' he can only receive blood from type 'O.' If there wasn't enough type 'O' donated blood available in blood banks, so they need to find a type 'O' blood donor. And currently, our blood banks issue a blood donate card. If someone needs blood, then blood banks ask about his or her family member's blood donation reports that currently those reports issue as papers. The patient needs to put forward those papers to the blood bank. But it is difficult and time-wasting. Using our system can find those reports in one second. But still, we did not use any automated platform to make a connection between blood donors and blood banks. In that case, find a required type of blood donor is difficult. By developing that Computerized blood donation system eliminates those issues and can find any blood donor very easy. Using that system, blood banks can see details about blood donors in their area. This system contains an android application for the blood donor and a Web application for the blood bank. We firmly believe that the computerized blood donation system solves all difficulties of the current manual system. We used modern technologies to develop our system.

1.1. **What is Blood Donation**?

Blood donation is the process whereby a person voluntarily draws blood and transfers it and converts it into biomass. Blood transfusion service was established in 1946. Donations can be from whole blood or specific components. Those are,

- Red cells

It contains an iron-rich protein called hemoglobin, which carries oxygen and makes the blood red.

- Plasma

"Plasma is a clear, straw-colored liquid that remains after the removal of red blood cells, white blood cells, platelets, and other cellular components. It is the largest component of human blood, comprising about 55 percent and contains water, salts, enzymes, antibodies, and other proteins".

- Platelets

These cells help to clot when we bleed. Coagulation prevents excessive bleeding from an injury. When platelets are low, severe, or life-threatening, bleeding can occur.

Today's world, most blood donors take blood donation as a community responsibility. And they donate blood as unpaid volunteers. But some donors are paid.

A blood donation also cares about the donor's safety. For that, the donor's haemorrhage or haemoglobin level is checked to make sure the blood loss is not anemic, and this is the most common reason the donor is inappropriate. Pulse, blood pressure, and body temperature are also evaluated.
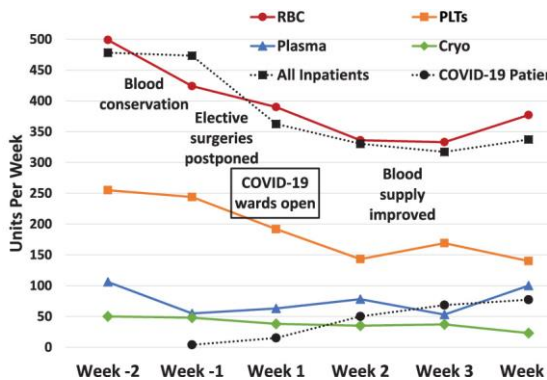

Figure 2. Overall weekly transfusions of all blood components in the study period
Source: (Christina M. Barriteau Patricia Bochey Paul F. Lindholm Karyn Hartman Ricardo Sumugod Glenn Ramsey, 2021)

Figure 2 shows the marked decline in overall weekly transfusions of all blood components in the study period, associated with enhanced blood conservation measures, canceled elective surgeries, the decrease in total inpatients as wards were cleared for future COVID-19 patients, and the increasing numbers of COVID-19 ward patients receiving RBCs, plasma, and PLTs at significantly lower rates.

This record took from USA research (Christina M. Barriteau Patricia Bochey Paul F. Lindholm Karyn Hartman Ricardo Sumugod Glenn Ramsey, 2021).

1.1.1. Blood donation in Sri Lanka

Only 37% of our country's population is eligible to give blood, and less than 10% of those who can donate do donate annually. The national blood transfusion service in Sri Lanka is control by the ministry of health. Every donor can donate once four months. All hospital-based blood banks have optimal storage facilities. After every blood donation, do testing of Donor blood specimens for TTI markers of HIV, HCV, and Syphilis infections (bank, 2021)

- Who can donate blood?
- The donor must between 18-60 years,
- Who has a valid identity card?
- A donor can donate blood once four months
- Free from pregnancy or any serious medical condition
- Free from drug addicts.

1.2. Business Objectives

The main objective of our project is to develop a computerized blood donation management system with blood bank management system. The Ministry of health manage blood banks in our system. And blood banks connected with other blood banks and blood donors. This whole system works through the internet. The blood banks able to send blood requests and information about nearest blood donation camps. And The donors can see that information through the Android app. Only The ministry of health can add blood banks to this system and can remove

blood banks from this system. The ministry of health able to see information about all blood donation camps in Sri Lanka and the blood supply of each blood banks. And the blood banks able to check information about blood donors. Blood donors have free to ask any questions about health via forum. Blood banks can give answers to those questions. The system will provide the blood exchange facility between blood banks. And this system can provide an E-blood-donation card instead of current blood donation card.

1.3. Project Objectives

This computerized blood donation management system will help to the Blood Banks, Health Ministry, blood donors and the community in many ways. Through the API, users can access the system using different platforms. The objectives are as follows,

- Design user-friendly interfaces that attract users

- API that facilitates connectivity across multiple platforms

- Make a good connection between blood banks and the donors

- Secure donors' privacy

- To the ministry of health,

Manage all blood banks, manage daily blood supply, Help to Do a Census of blood supply of each blood type

- To Blood Banks,

Manage their blood supply, organize blood donation camps, exchange bloods between other blood banks, find donors in an emergency

- To Blood Donors,

Online help to their health problems (Covid-19 virus infection), Same blood group teams, E-blood donation card, tracking their bloods and receive a thank you message, Nearest Covid-19 situation alert, Immediately connection between nearest hospital and the donor (Any Location)

- To the Community,

Help to find blood donor easily in an emergency.

1.3.1. Goal

Providing a best computerized blood donation system and make a best connection between blood banks and the blood donors, make a good blood bank management system instead of current manual system.

Figure 3. System Architecture

Figure 3 shows how our system works. There are four parties in our system. The community deals with the android app and hospitals and the minister of health deals with the web site.

2. LITERATURE REVIEW

Blood is needed every two seconds. "About one in seven people entering a hospital needs blood. One pint of blood can save up to three lives" (Report, 2021). Blood is always needed for treatment of accident victims, cancer patients, haemophiliacs and surgery patients. Only 37 percent of our country's population is eligible to give blood. Blood is of 8 types. Not all types are suitable for everyone. The life is the most valuable thing in the world. Blood is the most important lifesaver in an emergency. Today, most people in the world prefer to use technology-based systems. At the same time, more and more people in developing countries are accessing the Internet. Therefore, many countries use cloud-based blood tracking systems. With the help of cloud-based systems, their blood storage and blood supply can be easily measured. In the current pandemic situation, the information of the blood donation camp can be easily disseminated to the

community. Currently use social media to distribute those messages. Cloud-based systems are much more efficient than manual systems.

Benefits of Computerized blood donation system

The exact blood type can be found easily in an emergency,
Can manage daily blood supply easily, the blood supply can be easily determined, in an emergency health situation such as COVID-19 situations can get instructions from hospitals online, blood supply can easily exchange between the blood banks, donors donation records, health situation and more can check easily, blood donations camp can be easily organized and pass the message to the community easily.

2.1. Technical Review

Our system contains two websites and an Android application. It all connects to MongoDB via an API.We have considered efficiency, security, user-friendly interfaces, reusability, and open source to choose our technologies. And we use git as our version controller. Git has helped me a lot in improving the quality of our projects

Flutter as the android development framework

Flutter is best framework to develop mobile Applications. Developed by the Google. The main reason We chose flutter is hybrid framework. Therefore, can get Android and IOS app from same code. And flutter has many open libraries, and updates are always coming. Flutter is currently one of the most popular Android app development technology.

2.1.1.   Angular for web sites

Angular is a most popular TypeScript run type framework developed by the google. We used Angular10 to develop this site. Its component base architecture is helps to well organize complex codebases. It helps to handle APIs.

2.1.2.   Node. Js

Node.js is JavaScript based backend language. "Node is a JavaScript runtime environment that runs server-side. Within that environment, we

can use JavaScript to build our software, our REST APIs, and invoke external services through their APIs." (SILVA, 2020).

2.1.3.   Mongo Db

The Mongo Db is a NoSQL database. It has hosted database named Atlas. Mongo Db is a cross-platform document-oriented dynamic database, therefor fast that SQL database. There are no tables in Mongo DB. All are stored as collections. MongoDB Atlas provided me with an easy way to host and manage our data in the cloud.

3.   RESEARCH METHODS

In this case, first of all, information on the current blood supply in Sri Lanka was collected. It was then that we realized what the shortcomings of the current system are and how it fits into today's world. Understood how to use the current technology to replace the current traditional method and examined the key benefits of using new technology instead of the current method.

4.   PRIVILEGES OF THE PROJECT

There are many benefits from our project. They are described in detail below. This project helps the community a lot.

Safety In current pandemic situation users can get online medical helps from this app. No need to go to hospitals but the can connect with the nearest hospital through this app. It will big help to the community.Time is the most important thing when it comes to save a life.

Our system is a computerized blood donation system where the user can find any type of blood easily, ask questions about health and can get perfect answers from hospitals online, organize a blood donation camp easily, e blood donation card function, blood storage management, determine blood supply easily can do by using our system. If there is no system like this,

hospitals, the community, should do those things manually.
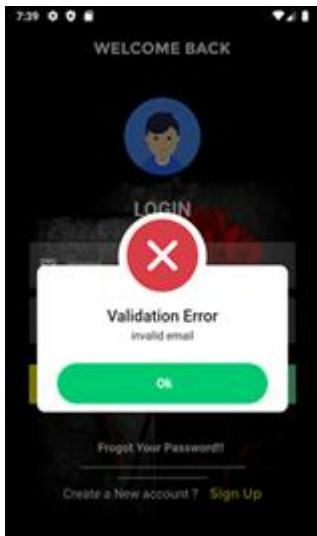
Figure 4. User Details Validation and Email Verifications
Time saving

4.1. **Attracts more donors**

Currently in Sri Lanka about 10 percent are donate blood annually. In our android application there is a sliding section to display how important to donate blood.
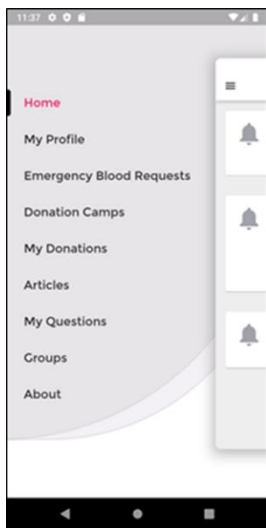
Figure 5. Attractive and User-Friendly UI
Security

We had to consider the donors data security. All data entered the system is automatically stored in the database. All passwords are encrypted, and the privacy of the donor is protected. They can ask questions but will not show who he is. And The hospitals can't see the user details without user's permissions.

4.2. **Easy to manage Blood Banks**

In this system has Dashboard that is for the ministry of health. Using this dashboard, the Ministry of health can manage all blood banks easily. Blood bank's all data is in centralized database. The ministry of health has privileges to access those data by using their dashboard. They can see about blood storage of each blood banks, blood supply and blood donations camps in Sri Lanka. And add blood banks only can do the Ministry of health.
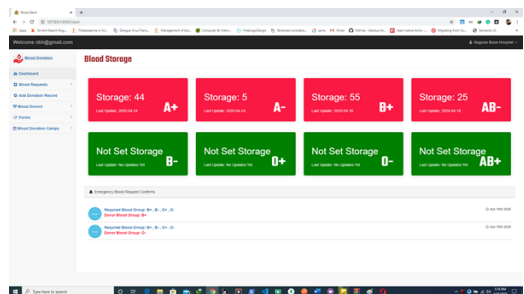
Figure 6. Dashboard the Hospital Staff Can Monitor Their Blood Storage and Can Check Notifications

4.3. **Emergency blood finder**

Blood is the most important lifesaver in an emergency. Blood is always needed for emergencies, such as treating accident victims. Some blood types may not be in the blood bank. In those cases, our system has an emergency blood tracking system. Blood banks can find blood from another blood bank or the nearest donor using their website.

Figure 7. Locations of Donation camps and Hospitals Displays on the Google Map
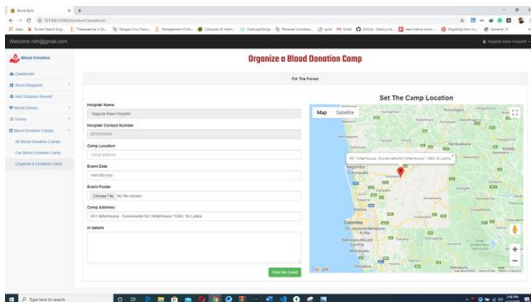
Figure 8. Hospitals can Organize Blood Donation Camps with the Google Map Locations

5. FUTURE IMPLEMENTATIONS

This system already has all functions of current manual system with additional Features. But in the second stage of this system, we wanted to add those things,

1. Image processing donor signup system

This method helps to add information to verified donors. Most donors have a valid license card. The license card contains the national identity card, name, and blood type details. When the donor uploads their license card photo, the system scans it and retrieves the details

2. Add sensor events

When the donor encounters an accident, the app detects trauma using sensors. Display the donor ID as a push notification. It helps hospitals to know about donor information. Only the hospital dashboard has the function to track donor information from ID.

3. Add fingerprint auto log in system

4. Add a Donor's blood pressure tracking system

6. CONCLUSION

Our goal is to develop a computerized blood donor finding system for Sri Lanka. COVID 19 reached the world and spread globally. And in Sri Lanka currently we are suffering 2nd wave of this COVID-19 virus. We saw real challenges with the current epidemic. The public gathering was not good, and we saw that the blood supply had dropped very rapidly. This system made as a solution for the blood supply. After researching the 19 COVID victims and gathering some details, we saw how important our application was in this situation. we strongly believe that this will help the lives of many in our community.

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Business during COVID: An IOT based Automated Sand Truck Management Solution

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ABSTRACT

The COVID-19 which has arrived from the Wuhan, Hubei province China to the world at the beginning of the 2020 and it has spread all over world with making huge number of damages to each country's health and also the economy. As a result of this, people are facing to challenges which has affected by the new virus called as COVID-19 and searching the best solutions to prevent this pandemic situation as possible as much to make the world where it has used to be before the COVID-19 virus. The COVID-19 is spread through hands, eyes and mouth because of that people use to sanitize or wash their hands after touching a surface when in a public place.

Keywords: COVID 19, Management system, Geological Survey and Mines Bureau, Police officers, innovation, engineering.

1. OVERVIEW

Now days people scare to touch anything which in public places. When coming to the current system of the sand truck system in Sri Lanka is conducted a manual process by checking the permit sheets one by one at the checkpoint when sand trucks arrives and the permit sheets are checked by the police officers. Checking a permit sheet is not a big deal before the COVID19 but now we should avoid touching surfaces which not belongs to you because we have to take care of our health an others health to prevent the COVID 19. As a solution for checking the permit sheets in manual, I've developed an automated sand truck system which has conducted through IOT based device and the mobile application. The computer technology offers computerized system to prevent the capability of having errors on sensitive data. Apart from that, the manual system is used for sand transporting which has been controlled by the Geological Survey and Mines Bureau of Sri Lanka. The permit sheet is offered by the GSMB to the truck owners which have transported the sand via the trucks. The permit sheet is having a manual process. The gross weight of the truck with sand is depended with the variations of the trucks. As a solution, the trucks which transport the sand are referred to the specific checkpoint that measuring the exact weight while the RFID card is detecting the truck details. Vehicle recognition using RFID card is the efficient solution to get rid of having short comes such as parking large scale trucks near the checkpoint, getting much time to sign their permit sheets from the specific police officer in the checkpoint and etc. Not only the GSMB but also, it's possible to apply to the many fields for the purpose of reducing traffic issues, roadblocks and parking management systems. This process is able to apply which typically the vehicle number is used to get the current information in daily as an alert message to the owner's account. Using the RFID technology to confirm the exactly information of the selected truck or if there's any error, then it will automatically inform to the owner via an alert message with the GPS current location of the truck. The project eSand Transport System with IOT(eSTSI) has been carried out to implement the sand transport system which will perform as the real time surface for the GSMB or any company which relates to the detecting the

specific vehicle using RFID Card that allows you to provide the secure and accurate data such as gross weight with the sand and the truck, viewing the details of the owner when the RFID card is detected, sending alerts as messages through the app which has been connected with the firebase, viewing the schedule of the selected truck with the date and the destination and displaying the location once the truck is passed the checkpoint. The main functionalities of the eSTSI is to identify the truck with the correct information via the RFID card that retrieves the data who has enrolled with the app which stores the data in the firebase. The expected services are aimed to provide by this system.

2. Wʜᴀᴛ ɪꜱ ᴇSTSI

Weight Measurement: The axel weight or gross of the passing sand truck is able to measure dynamically by using the sensors installed in the ground level of the specific pavement. The typical measuring method of this is interacting between the truck's tires and the sensor. This typical measuring method is an inaccurate method because the entire tire patch is not able to cover by the sensor. The Weight-In-Motion method is suitable to get higher accuracy weight measure of the selected truck. The wheel load of the entire moving sand truck is caused by the pavement strain. The time duration for longer forcing is covered by this WIM method. The pavement strain is considered to expect for getting higher measurement accuracy. Load cell measurement: The horizontal load and the narrow space measurement are the possible measurement for this project. , the sponge cell is confirmed to use instead of using the organism soft tissues.

Vehicle Weight: The automatic vehicle load monitoring and navigation monitoring system are designed by using many equipment. But the in order to the qualities, the load cell which acts as weight sensing device is attached to the bottom of the sand truck, the suspension springs of the sand truck is attached with the weight sensing device as known as load cell, To convert the load cell resistance into the voltage then the weight sensing device is attached with conversion unit to convert the output as resistance, the voltage

conversion unit and the automatic vehicle location data, the sand truck location data and the voltage data are received to AVL for connecting with the central server, The driver of the sand truck is communicated for the purpose of sand truck location data and sand truck load simultaneously.

Figure9-IOT Device Model for Demonstrating the Real-World Scenario

3. ᴇSTSI Cᴏᴍᴘᴀʀᴇᴅ ᴛᴏ Cᴜʀʀᴇɴᴛ Sʏꜱᴛᴇᴍꜱ

This eSTSI project is concerned about to develop the computerized system with truck recognition IoT device and the smart mobile application to get rid from the manual system which had used to be signed the sheets when the sand trucks are passed the checkpoint. This system is aimed to provide the expectations of the users like truck owners and police officers who handle the process of sand transporting, as well as prevent their limitation due to lack of memory loosing of storing the data using physical things such as permit sheets and prevent for having large scale storage areas to store their physical permit sheets.

The project domain has initiated the development of eSTSI is vehicle recognition authentication and firebase authentication for verifying the exactly data with the selected RFID card which has assigned for specific sand truck. Basically, the development is carried out from concerning to provide the reliable and effective sand truck system where is has installed. This system which includes the mobile application and IoT device is capable to authenticate the users in both items. The process of authentication in mobile application is authenticated the users by using the Firebase cloud platform which users are login or signup to the app using their emails and which users have their details enrolled in the Firestore collections. The process of authentication in the IoT device is authenticated by using the RFID technology. The authorized person like police officers is handled and controlled the entire process. Once the enrolment is done, the users are allowed to use the mobile application without having the support from any outsider. The mobile application is facilitated to edit records in the user profile, get the current location of their sand truck, add schedules using the calendar view option, add truck details and etc. to the users. When the details are added, then all the data stored in separate collection of Firestore with Firebase which has cloud platform and real time database. And also, the
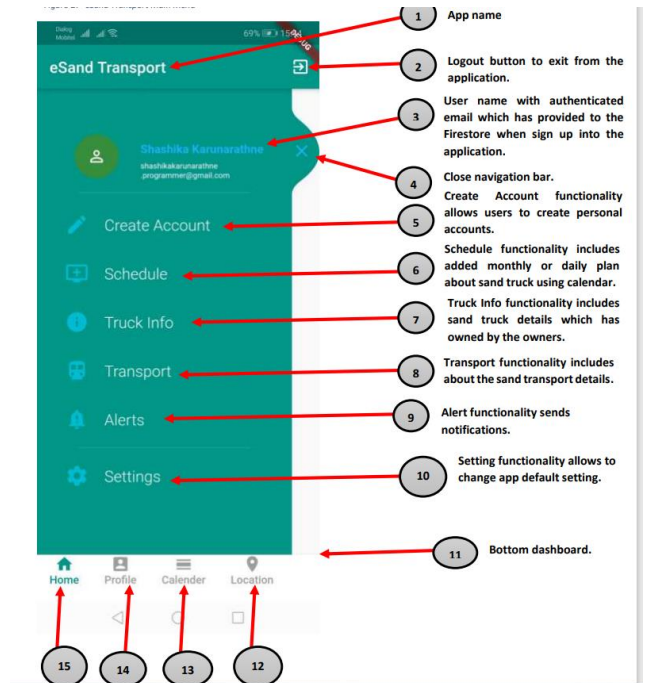
Figure 3- eSand Transport Main Menu
like harbor, public transport etc. The eSTSI

Figure 2-- IOT Device model- RFID UID reading process using LCD display

necessary details are retrieved on the separate screens on the mobile application when clicks the specific action buttons in the application. eSTSI is not aimed only for the sand transport system but also this might be useful to relevant sectors

Figure 10-- IOT Device model- RFID UID reading process to grant the sand truck using LCD display 2
project has been addressed the Human Computer Interaction issues because of the most of time this mobile application will be used and accessed by the non-computer literate people. Less complexity and high user friendliness are provided to access the system without having unnecessary details.
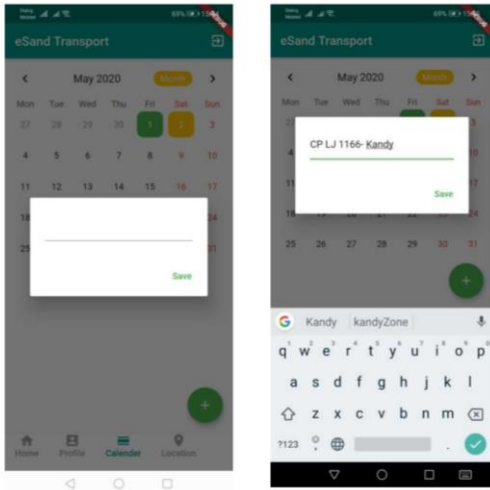
Figure 11- eSand Transport calendar add schedule

4. RFID, LOAD CELL TECHNOLOGIES AS BACKEND

IoT based RFID sand truck identification system is used Arduino Node MCU ESP8266 Arduino & Firebase cloud platform. The RFID cards are scanned by the Arduino and RFID scanner and then log into the data to Firestore through the Firebase authentication cloud platform with the support of ESP8299 Wi- Fi module. The information which are identified by the RFID, can be displayed in the Firebase and possible to access the authorized parties to view and identify the detected sand trucks over the internet.

Proudly, looking at the project Sand Tranport Management System using RFID and Load Cell technology is able to show how far the hard work and knowledge are performed to achieve the expected task into real. The modern and exist technologies are required for the Sri Lanka to develop the country into a better tomorrow than yesterday. By this point, this sand transport system with RFID and Load cell technologies is a system, which has still fresh and new technologies to our country Sri Lanka. As a software engineering undergraduate student, this was the most cheerful movement to identify my strengths to do something new to this country using modern technologies. This system is able to invent which has required for the developing countries like Sri Lanka and other countries. When working with RFID technology, before applying to the system there're a lot of parts to study and apply the correct one to the project. But the RFID technology is the most effective method for identifying the sand trucks rather than using other technologies. There's huge amount of knowledge to study about the RFID technology. But it was very simple when working with RFID after having enough knowledge about the RFID and its technology. The IoT device is included many technologies not only RFID and Load Cell but also Thinkspeak, Adafruit.io, Firebase and etc. The Thinkspeak is used to send the data from IoT device to the cloud to store and secure purposes. The Adafruit.io is used for getting AIO Key and username to add into the IoT device. The Firebase is used to connect the both IoT device and mobile application. And also it used to login and signup authentication purposes for mobile application via email authentication. The mobile application framework is from Flutter which has developed using Visual Studio Code and Android Studio. And the Firestore is used to create collections to store the data which has arrived from the mobile application to store the data in high secure level. By these points, I'm happy to use my strengths to do this kind of project for developing even when there're limitations and challenges to finish the expected task into real.

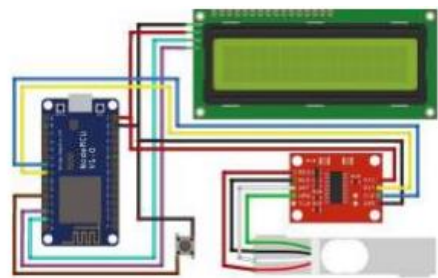Figure 12-Circuit diagram for HX711 and NodeMCU

5. CONCLUSION

The initial objectives and the expectations of the eSand Transport Management System with IoT Based are achieved effectively when it in conclusion is possible to guarantee. The sand

truck management system is provided the huge quantity of tasks which convenience to the included parties. The time is possible to save by both parties such as sand truck management authority and the sand truck owners. The vehicle recognition by using RFID technology is the most effective method for the modern world for preventing the time wasting and high cost. The Load Cell technology is used to measure the current weight for comparing the current weight and the entered weight for the system. The eSTSI project is covered the initial scope effectively. The objectives and the scope which has included in eSTSI achieved successfully. This project isn't only for academic task which has gained but also related the project process which helps for developing skills such as resource management, time, working under pressure and decision making.

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How to Attract Sri Lankan Youth for Agriculture by Using Information Technology

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ABSTRACT

Agriculture is fundamental to the development of every country in the 21st century, and each developed and developing countries invest in it. However, in a developing country like Sri Lanka, fewer people be a part of the industry and attract limited investment. At the same time, the contribution of the youth community is very low. Youth participation in agriculture is very important to make a sustainable contribution to national development. Many young people access information from the internet. Therefore, the internet was the best platform for young people to market and promote agriculture. Also, new technology and software applications must be used to attract young people to agriculture. This research seeks to identify the reasons for the declining contribution of the youth community to agriculture and to provide IT-based solutions to these difficulties. The survey was conducted in consultation with farmers in the Bulathsinhala area and by obtaining data from them. It was also important to consider their family background. Data was also collected from 100 youths in the selected area and most of whom were between the ages of 15 and 33. The main reason for selecting the Bulathsinhala area for this research was due to the largely rural area and the large number of people involved in agriculture as well as paddy and Chen's plantations and the ability to obtain data from farmers and their children in such an area and to know their problems. The prevailing underestimation in the society of the youth towards agriculture, Lack of proper guidance to focus on agriculture, Lack of suitable media for obtaining agricultural information, do not have land suitable for agriculture, Difficulty finding a suitable market to sell the harvest, are several factors that contribute to the decline in youth participation in agriculture after the observation. To increase the attractiveness of the youth as well as for the convenience of the farmers and the convenience of all those engaged in agriculture, the solution provided by this research is to implement a mobile application that contains features on Facebook and YouTube.

Keywords- Agriculture, Information technology, Sustainable contribution

1. BACKGROUND

By 2020, the total population of Sri Lanka around 28 million(*Sri Lanka Demographics Profile*, 2020). About 33.7%(*Food and agricultural organization in United nations*, 2021) of the total population of Sri Lanka is engaged in agriculture as their occupation.

But the contribution of the youth community to agriculture is very low. The youth community is always trying to move away from agriculture to work in offices, factories, etc. At least they are not too keen on cultivating their backyard.

But Sri Lanka's economy is largely dependent on agricultural products, but we have to import a lot of the food we need. The reason for this is the insufficient number of crops grown in Sri Lanka. The reason for such insufficient food is the shortage of growers in Sri Lanka. Although the

young generation in Sri Lanka is more inclined towards agriculture, we will be able to easily produce the food we need. It will also be able to reduce youth unemployment in Sri Lanka. To this end, by exploring the reasons why young people are not inclined towards the industry and providing them with IT-related solutions, they will be able to save a lot of money on food imports in our country if they can be actively used for cultivation.

The modern youth are very much associated with information technology, but when we look

at Sri Lankan agriculture, it does not appear to be technologically advanced. It is always done traditionally from the past. But young people do not want to resort to agriculture only through traditional methods. Therefore, new technology and software applications should be introduced for the industrial sector as well as for all other sectors. Then even a person who is reluctant to engage in agriculture can turn to it and experiment or come forward. Therefore, to keep agriculture in Sri Lanka active, more and more young people need to be added to it with the latest technology.

Most of the cultivation in Sri Lanka is done by the elderly (Sri Lanka LabourForce Statistics, 2020). Sri Lanka's youth are less inclined to engage in agriculture. This research aims to identify the measures that need to be taken to actively involve the youth of Sri Lanka in the up liftmen of agriculture based on ICT-based solutions.

2. RESEARCH OBJECTIVES

- Identify the challenges facing the youth in directing them to agriculture based on the current system in Sri Lanka.
- Identify the existing information systems in Sri Lanka related to agriculture and identify the extent to which these information systems are used by the youth community in Sri Lanka.
- Identifying the strength, weaknesses, opportunities, threats in creating an information system to involve the youth

community in the development of agriculture in Sri Lanka.
- Provide reasonable solutions to more engage youth in agriculture with information technology.

3. METHODOLOGY RESEARCH DESIGN, DATA GATHERING, AND DATA ANALYZING.

3.1. Research Design
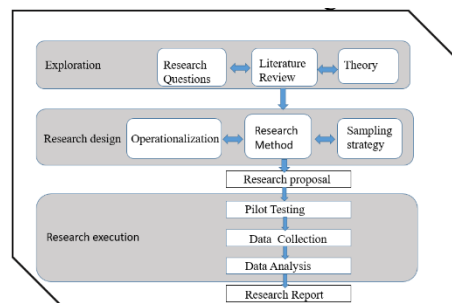
Figure 1. Research design process

The basis on which the entire process is based is provided by research methodology, which is an essential component of any analysis. We will go into how the research was carried out in this section. It begins with a summary of the research areas, followed by the main elements of the research methods used, which include the research design, data collection techniques and instruments, and data analysis and interpretation. The choice of an acceptable research design is critical for any investigation to ensure that the evidence gathered allows us to address the initial research question. As a result, the study's research design was the Descriptive and Quantitative Survey Research Design. This Survey Research Design examines small populations (samples) to determine the relative frequency, dispersion, and prevalence. This Survey Research Design investigates the relative frequency, distribution, and interrelationships of variables in small groups (samples). It was based on interviewing a small subset (sample) of a population and evaluating data to address or explain set characteristics.

Both qualitative and quantitative data should be used in this research. This is because statistical

data alone are not sufficient to obtain highly accurate information

3.2. **Conceptual framework**
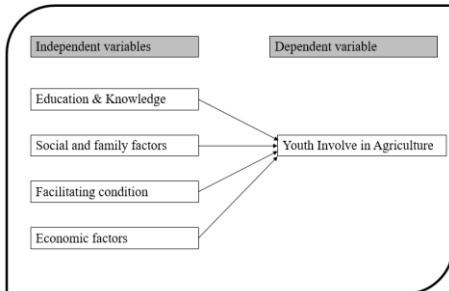
Figure 2. Conceptual framework

According to figure 3.2.1, there are two main variables. They are independent variables and dependent variables. According to that youth involved in agriculture is dependent on education & knowledge, social and family factors, facilitating condition and economic factors. In feather of this research, we will discuss the above facts in more detail.

3.3. **Population and Sample Selection**

Our population is youngers in the Bulathsinhala area. In there we hope to carry out a sample of 100 youngers from the Bulathsinhala area in the western province. When selecting the sample, we plan to use random sampling and the stratified sampling method. Also, we hope to obtain the assistance of Agrarian Regulators and Agrarian Services Department Officers in the Western and province to make this research a success.

The main reason for selecting the Bulathsinhala area for this research was because the area is largely rural and has many people engaged in agriculture as well as paddy and Chena plantations.

3.4. **Data collection**

There are 3 main methods we used to collect data. Here we collected primary data and as well as

secondary data by using the below methods.

3.4.1. **Questionnaire**

Here we collected information using the selected sample by presenting a list of questions.

3.4.2**. Interviews**

We gathered information from youngers in the Bulathsinhala area by conducting interviews here. In there we conduct our interviews in the Sinhala language. Then after converted it into the English language and notified their data.

3.4.3. **Refer existing document**

Here we gathered information using published documents and leaflets available in the Agrarian Services Department.

Before creating the questionnaire, did some interviews with Agricultural office members and had some discussions with people in the Bulathsinhala area. After those discussions, we identified some sort of problems related to "why youngers are not engaging in agriculture". After that, we prepare some questions and did some pilot versions of data gathering. There Also we could be able to identify some mistakes related to our questionnaire. (Ex: Some people are not in our age category). Because of that, we change our questionnaire again. After we gather data by using the below questionnaire.

The questionnaire was mainly used for data collection, which included multiple-choice questions, 3 points Likert-type scale and 5-point Likert-type scale questions, and a short answer question that could be presented independently.

This questionnaire included the age limits of the young people who took part in the test, the nature of their family's main occupation, their marital and unmarried status, their interest in agriculture, the problems they face when approaching agriculture, and their willingness to use information technology, and the use of smart devices. Inquired about, how to use different internet platforms and the available sources for them to get information related to agriculture.

In using these questionnaires, we presented questions based on two main categories. Those

two categories are the likes and dislikes of agriculture

4. LITERATURE REVIEW

4.1. Young professionals and their career development

In Sri Lanka, the labor force engaged rate is 51% (Department of Census and Statistics Ministry of Finance, 2020) of which 65.7% (Department of Census and Statistics Ministry of Finance, 2020) are males and 34.3% (Department of Census and Statistics Ministry of Finance, 2020) are females. Since 2015 (Department of Census and Statistics Ministry of Finance, 2020) male participation in the labor force is always higher than female participation. The higher the level of education, the higher the labor force participation rate, but the higher the level of education of women is also more likely to be unemployed than the possibility of employment. In addition, our research results show that the market behavior of young women is affected by family expectations and resources, which involve the protective role of young daughters in the family, and cultural differences in the acceptance of young women by different groups. Therefore, the proportion of men participating in agriculture is always higher than that of women.

There are 3 main industry categories in Sri Lanka. They are Agriculture, services, and Industries. During the first quarter of 2020, about 26.5% (Department of Census and Statistics Ministry of Finance, 2020) in the agriculture sector, 46.4% (Department of Census and Statistics Ministry of Finance, 2020) engaged in the service sector, and 27.1% (Department of Census and Statistics Ministry of Finance, 2020) engaged in the industry sector. The proportion of the unemployed population to the total labor force is 5.7% (Department of Census and Statistics Ministry of Finance, 2020). Based on the total labor force there are 26.8% (Department of Census and Statistics Ministry of Finance, 2020) in ages 15 to 24 unemployed. This is the highest percentage of all age groups because this age group includes students from GE A/L and students from GE O/L. The ratio of the number

of unemployed to the total labor force is called the unemployment rate. In District 29, the unemployment rate is 11.6% (Department of Census and Statistics Ministry of Finance, 2020). The highest unemployment rate is 10.1% (Department of Census and Statistics Ministry of Finance, 2020) in the G.C.E A/L and above group.

4.2. Agriculture as a career choice

Choosing the right career path is getting increasingly more significant for young students today. Understudies need to consider numerous things while picking a vocation and college major and there are numerous professions in agriculture from which understudies may pick. Also, there are great opportunities for headway and occupation positions in the agricultural field. (The University of Tennessee, Martin, December 2013)

Educational projects in farming are in direct rivalry with projects like designing, business, and medication which are decided by the general population as being more glamorous and career promising. Accordingly, skilled talented youth students are being guided or pulled in into such projects in the quest for economic security and status.

This pattern of declining enlistments in agriculture programs is adding to a deficiency in the accessible supply of people with information and skill in the food and agricultural sciences. Students' apparent agriculture as science-arranged, but they did not know its importance as an industry and the professional potential.

Fishbein and Ajzen (1975) verified that expectations to participate in activity could be anticipated dependent on an individual's knowledge, perceptions, or other information held about some issue or event and this proposed that the choices of people to choose or not to choose agricultural as a field of study or to turn out to be effectively occupied with an agricultural career might be anticipated by inspecting their convictions about agriculture. (Jesse C. Thompson, 1993)

4.3. **Agricultural education and training**

The decline of youth engagement in agriculture worldwide in the middle of an increasing global population remains a big challenge to ensuring food production for future generations. In Sri Lanka approximately 26.5% (Department of Census and Statistics Ministry of Finance, 2020) of the total labor force is engaged in agriculture. It holds one of the most important sectors in Sri Lanka. Among Employed females, in Sri Lanka 27.7% (Department of Census and Statistics Ministry of Finance, 2020) is in the agriculture sector while this share is 25.9% (Department of Census and Statistics Ministry of Finance, 2020) for males. As we observed, young people don't like farming. The major problem is the sharing, use, and collection of information. You farm without any understanding of technology, and you don't have access to proper information, up to date.

This impacts you to take optimum decisions on your crops on time. Most young farmers are deprived of knowledge on crops, appropriate fertilizers, water needs, land preparation, techniques of cultivation and harvesting, and real-time information on situations such as current levels of crop output, pest and illness outbreaks, and market pricing. These elements cause individuals to fail since they lack a focus on their job growth, too. Traditional farmers still use their ancient techniques to cultivate their land without contacting modern technologies. Except for modern technology, they still live with the old hard method. To contact new techniques, you need a decent lead. Newbie farmers are struggling with agriculture involvement.

The key point is the collection of information. And no one around them, save the government, is taught new techniques. You move away from agriculture since you have no notion about your vocation. You need competent counsel on agriculture with up-to-date facts.

4.4. **Attract young people to agriculture**

The poor condition of youth cooperation in agriculture activities in Kenya has involved great concern among agriculturists, agrarian specialists, and administrators. For a nation to accomplish financial security the agricultural field should be lively, and the youths supported soaking up farming as a noble profession. Youths can defeat a portion of the significant limitations to growing animal creation in developing countries, for example, pest control, hereditary improvement, feeding, and protection against hunters since they are frequently more open to groundbreaking thoughts and practices than adult farmers. They attempted these things to get youngsters associated with agriculture to receive the rewards of the inventive work of the adolescent in agriculture. The part of youths in agriculture improvement in the study section, Local area based non-formal youth agricultural educational projects, Issues restrain youth cooperation in agrarian exercises. (Dr. Francis Ofunya Afande, 2015)Public Commission on Farmers focused on attracting for drawing in and holding educated youth in farming. The agriculture that draws in them should be beneficial, cutthroat, and dynamic. For this, innovative and administrative up-degree of farm tasks is quickly required. An Agricultural Transformation Movement is needed at present to meet these prerequisites. Rural expansion administrations can successfully urge youth investment to change horticulture as they will receive new thoughts and advances.

In addition, it was noted that wide-ranging communication openness and the expansion of the office contact affected youth to participate in exercises to produce horticultural payments.

More NGO collaboration, counseling, and monitoring of country kids, attention to youth programming, improved entrepreneurship, the expansion of natural farming and agri-business might form part of this persuasive method. In the field of young consideration in agriculture, also mass-media and information and communication technologies (ICTs) may be employed successfully. Examples of how innovative young farmers or arbitrators overcome difficulties might be shared through radio, TV, and publications to encourage other young farmers.

"Digital Green" works through people expansion frameworks utilizing participatory recordings. It makes a platform for instructed youth to approach in serving the agricultural local area in a participatory model. Additionally, the huge organization of agrarian colleges and universities can assume the main part in teaching self-assurance and capacities in the understudies needed for taking up farming as a calling. Homestead graduates can start with the starting of Agri-clinics and agri-business focuses (ACABC) in towns as provincial enterprises. ACABC plans as effectively under operation, should be reached out to obliging bigger quantities of agricultural graduates in villages to fire up new agricultural projects. (Sukanya Som1, 2018).

4.5. Investments in agricultural research

Sri Lanka's government expenditure on agriculture research is only being tested and implemented in emerging regions excluding rural ones. Thus, rural regions will not meet agricultural knowledge flow. The Sri Lankan government presents commercially viable crops and encourages farmers to produce the crop by giving all the ingredients required for the production. The Government of Sri Lanka can introduce Aloe Vera, vanilla, cardamoms, cinnamon, and ginger (Jahan F, 2017). With these government investments, farmers are farming them extremely effective in certain places, while some farmers are powerless to achieve success even if these crops are correctly grown. Therefore, the governments have carried out these initiatives throughout the island, but because the cultivation was unsuccessful and farmers were severely uncomforted, they did not pay care to their land. The study into agriculture should be centered on the land of the farmer.

4.6. ICT in agriculture

ICT in agriculture is an arising field focusing on the upgrade of agriculture and country improvement. The progression in ICT can be used for giving precise, convenient, pertinent information and services to the farmers, accordingly, working with an environment for more gainful agriculture. The basic issues in the selection of ICT in-country portions are ICT ignorance, accessibility of important and restricted substance in their language, simple and reasonable availability, and different issues as mindfulness and readiness for the reception of new technologies among the rural people groups and so on. (Manish Mahant, 2012)

Agro informatics assumes a fundamental part in the economic and social improvement of the country. Typically, agricultural framework and manpower were considering as the two fundamental elements for agricultural improvement. But the most fundamental explanation that gives development and extension is "Information" utilizing the new technology.

The agriculturally successful rising nations like India can't disregard agriculture in such a change. The arising ICT have a noteworthy part to act in agricultural development. There are numerous capabilities of a combination of ICT in agricultural, utilized for the agricultural and rural development. (Virendra Singh, 2014).

4.7. Strength and weaknesses in creating an information system to involve the youth community in the development of agriculture.

Many factors affect agricultural production this includes overproduction, Underproduction, pest and disease attacks, and market price fluctuation (Ginige A., 2019). When analyzing these problems revealed that the connection between farmers and stakeholders is in poor condition. They won't receive any correct information at the right time when they need it most. Farmers need real-time information such as current crop production levels, market prices, and pest and disease outbreaks (Ginige A., 2019). Farmers barely using mobile devices to get agricultural base information. If farmers get used to IT-based information systems, they can easily get information about real-time weather, ongoing disease attacks, current market price, etc. Even they can communicate with other farmers and share their knowledge, experience with them.

The lack of a proper online information system regarding the agricultural sector in Sri Lanka

today can be seen as a shortcoming. Low-income farmers face many problems when it comes to IT. Are, some of them do not have proper devices to handle them, if they have a device, they might don't know how to operate it properly. Also, some rural areas have no signals to their mobile devices.

4.8. **Mobile applications in agriculture**

Mobile communications technology has immediately become the world's most regular method of communicating voice, information, and services in the developing world. Given this sensational change, mobile applications (m-applications) in general and mobile applications for agricultural and rural development (m-ARD applications) specifically hold critical potential for propelling turn of events.

Most m-ARD applications center around improving agricultural production network reconciliation and have a wide range of capacities, for example, giving market sector data, expanding admittance to augmentation benefits, and working with market links.

Users are additionally assorted, including farmers, produce purchasers, cooperatives, input providers, content providers, and different partners who request helpful, moderate services. (Christine Zhenwei Qiang, 2012).

Also, Agriculture Information System (AIS) is a PC-based data framework that contains all the interrelated data which could truly help farmers in overseeing data and policy decision making. The ICT devices that help to work with farming exercises enveloped applications like mobile phones, radio, TV, cells, PCs, tablets, and networking, hardware and software, satellite systems. The Internet and web-based applications are broadly utilized in sharing and scattering agricultural information, promoting products and services. (Abdulrahman Saidu, 2017).

5. DATA ANALYSIS

categorized the information obtained there into two categories. If so,

- Socio-Economic profile of data providers
- Socio-Psychological profile of data Providers

Table 1- Socio Economic profile of data workers

Social personal characteristics	f	%
Age categories(Years)		
below 15	0	0.00%
15 -18	9	8.90%
19-22	14	13.90%
23-26	30	29.70%
27-30	24	23.80%
31-33	24	23.80%
above 33	0	0.00%
Education status		
Have passed grade 5	1	1.00%
Have passed Grade 8	7	6.90%
School leavers	39	38.60%
Diploma holders	23	22.80%
Degree holders	19	18.80%
Ph.D. holders	12	11.90%
Family main occupation		
Farming	15	14.90%
Business	34	33.70%
Agricultural labor	6	5.90%
Does not have a job	11	10.90%
Other	35	34.70%
Marital status		
Married	31	30.70%
Unmarried	70	69.30%
Landholding		
< 1 acre	25	25.00%
1 - 4 acre	45	45.00%
>4 acre	18	18.00%
no idea	12	12.00%

An examination of Table 5.1.1 reveals many respondents were between the ages of 23-33. the majority (38.6%) qualified up to the final year of their schooling (Grade 13) and farming as their main family occupation (14.9%). Regarding marital status, 69.3 percent of respondents were single and the majority (45%) of respondents had 1-4 acres of land.

According to the socio-Psychological profile of data providers,

Table 2-Main Agricultural Information

Main agricultural information providers in the village

Main agricultural information providers

	Frequent (5) f	Normal (4) f	Occasional (3) f	Rare (2) f	Very Rare (1) f	Total f	Mean score
Neighbors	10	40	26	11	13	100	3.23
Extension workers	3	50	17	10	20	100	3.06
Grama Niladhari	5	30	30	27	8	100	2.97
Samurdhi Officer	10	45	19	12	14	100	3.25
Agriculture Officer	25	45	12	7	11	100	3.66
KRPS	20	35	22	12	11	100	3.41
Other government officials	3	38	30	9	20	100	2.95

Confidence in the accuracy of information

	Strongly believes (5) f	Believes (4) f	Is indifferent (3) f	Believes slightly (2) f	Does not believe (1) f	Total f	Mean score
Neighbors	13	37	26	11	13	100	3.26
Extension workers	5	48	17	10	20	100	3.08
Grama Niladhari	8	40	20	24	8	100	3.16
Samurdhi Officer	9	45	20	12	14	100	3.23
Agriculture Officer	15	45	17	12	11	100	3.41
KRPS	15	35	27	12	11	100	3.31
Other government officials	3	38	27	12	20	100	2.92

According to Table 5.1.2, we can see that most of the information that respondents receive comes from agricultural officials. It has a mean score of 3.66. Also, the accuracy of the information obtained is highly relied upon by the information provided by the agricultural officers. Its mean score is 3.41 and it is a high rank.

Let's see how about the social psychological profile of the respondents.

Table 3-Socio-psychologcal Profile

Characteristics (score)	f	%
Attitude towards farming		
Less favorable	26	26.00%
Moderately favorable	50	50.00%
Highly favorable	24	24.00%
Achievement Motivation		
Low	13	13.00%
Medium	42	42.00%
High	45	45.00%
Credit orientation		
Low	13	13.00%
Medium	54	54.00%
High	33	33.00%
Decision-making behavior		
Low	7	7.00%
Medium	68	68.00%
High	25	25.00%
Economic Motivation		
Low	8	8.00%
Medium	53	53.00%
High	39	39.00%
Leadership ability		
Low	16	16.00%
Medium	58	58.00%
High	26	26.00%
Risk orientation		
Low	30	30.00%
Medium	42	42.00%
High	28	28.00%
Aspiration		
Educational	28	28.00%
Occupational	43	43.00%
Economic	12	12.00%
Social	11	11.00%

According to table 5.1.3, most of the respondents have higher motivation to do a particular task. So, it's a very good mark when involving with new tasks. also, most of the respondents (43%) aspiration is an occupation involving agriculture.

The relationship between the various socio-personal, psychological, information technology uses and economic characteristics of the respondents with an attitude towards farming was considered here.

Accordingly, the information is presented in Table 4 below,

Table 4-Social, Economic and Information Technology

Characteristics	Attitude youth towards farming (R-value)
Age	0.15
Education of respondent	-0.24
Family occupation	0.29
Landholding	0.34
Use of social media	0.3
Formal info. source for farming	0.1
Social participation	0.07
Informal sources of information for farming	0.09
leadership ability	-0.25
Credit orientation	-0.01
Achievement motivation	-0.22
Risk orientation	-0.28
Decision-making behavior	-0.42
Overall aspirations	0.08

5.1. **Hypothesis analysis**

Table 5-Hypothesis Analysis

Hypothesis	Null(H0) and alternative(H1) hypothesis
Gender influences the focus on agriculture.	• H0 - It is the male youth community that often focuses on agriculture. • H1 - It is not the male youth community that often focuses on agriculture.
The quality of education has an impact on the focus on agriculture.	• **H0 - Most of the focus on agriculture is on young people who have dropped out of school and are working up to grade 8** • **H1 - Most of the focus on agriculture is not on school dropouts and those who have studied up to grade 8**
It shows a change in the tendency to turn to agriculture according to different age levels.	• H0 - Young people are mainly involved in agriculture (Age between 21-33). • H1 - Young people are not primarily focused on agriculture (Age between 21-33).
The agricultural knowledge possessed by the people who are engaged in agriculture helps them to advance in that field.	• H0 - People who focus on agriculture do not have a clear understanding of agriculture. • **H1 - People who focus on agriculture have a better understanding of agriculture**
Most young people use smart devices to fulfill their needs.	• H0 - Many young people use smart devices. • H1 - Most young people do not use a

The above hypothesis was then studied. It first looked at past research and reports on how to focus on agriculture based on gender. The chi-square score method was used

Table 6-Hypothesis Analysis

Null hypothesis - H0	It is the male youth community that often focuses on agriculture
The alternative hypothesis- H1	It is not the male youth community that often focuses on agriculture
Significance level	0.05
P-value	0.69
Conclusion	After gathering data from the youngers in the Bulathsinhala area we did statistical analysis on that data. In that analysis we could be able to identify P-value is 0.69. Our significant level is 0.05. So, our found value is above our selected significant value. Therefore, its fail to reject the null hypothesis. It means most of the time males are more involving in agriculture.

It then looked at how the quality of education has an impact on the focus on agriculture and how it affects the focus on agriculture.

Previous research has shown that most school-educated people are drawn to agriculture. There, the accuracy of this statement was studied using that data. Based on the T-test value, a P-value was obtained, and the following conclusion was reached.

Table 7-Hypothesis Analysis

Null hypothesis - H0	Most of the focus on agriculture is on young people who have dropped out of school and are working up to grade 8
The alternative hypothesis- H1	Most of the focus on agriculture is not on school dropouts and those who have studied up to grade 8
Significance level	0.05
P-value	0.051
Conclusion	After gathering data from the youngers in the Bulathsinhala area we did statistical analysis on that data. In that analysis we could be able to identify P-value is 0.051. Our significant level is 0.05. So our found value is above our selected significant value. Therefore, its fail to reject the null hypothesis. Its means most of the focus on agriculture is on young people who have dropped out of school and are working up to grade 8.

Let's see what the most preferable age for youth is to involve with agriculture. According to previous research, it said age between 21-33.

Table 8-Hypothesis Analysis

Null hypothesis - H0	Young people are mainly involved in agriculture (Age between 21-33).
The alternative hypothesis- H1	Young people are not primarily focused on agriculture (Age between 21-33).
Significance level	0.05
P-value	0.054
Conclusion	After gathering data from the youngers in the Bulathsinhala area we did statistical analysis on that data. In that analysis we could able to identify P-value is 0.054. Our significant level is 0.05. So our found value is above our selected significant value. Therefore its fail to reject the null hypothesis. Its mean most preferable age group for involvement with agriculture is 21-33

Let's see how youngers use smart devices for their day-to-day task. According to the hypothesis, which is how does youngers use smart devices for their day-to-day activities.

Table 9-Hypothesis Analysis

Null hypothesis - H0	Many young people use smart devices.
The alternative hypothesis- H1	Most young people do not use a smart devices.
Significance level	0.05
P-value	0.64
Conclusion	After gathering data from the youngers in the Bulathsinhala area we did statistical analysis on that data. In that analysis we could able to identify P-value is 0.64. Our significant level is 0.05. So our found value is above our selected significant value. Therefore its fail to reject the null hypothesis. It means most of the youngers use smart devices for their day-to-day tasks.

According to previous research, in society, there has some number of positive attitudes for youth engaged in agriculture.

Table 10-Hypothesis Analysis

Null hypothesis - H0	Society's view on 'young people turning to agriculture' is good.
The alternative hypothesis- H1	Society's view on 'young people turning to agriculture is not good.
Significance level	0.05
P-value	0.02
Conclusion	After gathering data from the youngers in the Bulathsinhala area we did statistical analysis on that data. In that analysis we could able to identify P-value is 0.02. Our significant level is 0.05. So our found value is below our selected significant value. Therefore null hypothesis was rejected. Its prevailing societal view of youth engaging in agriculture is not good.

6. SWOT ANALYSIS

Based on the information gathered, a SWOT analysis was performed as follows. Following are some of the findings of our focus on agriculture.

Strength

- About 30% (Based on interviews) of the labor force is engaged in agriculture in the Bulathsinhala area.
- More than 19% (Based on interviews) of the total population is under 33 years of age in the Bulathsinhala area.
- There is a strong desire among young people to focus on and study new technologies.
- The ability of young people to accept challenges and adapt to change.

Weakness

- Many young people do not pay much attention to rural agriculture as they pay more attention to the activities taking place in the urban environment.
- Many young people lack an understanding of harvest and post-harvest technology.
- Limitation of knowledge on agricultural technology and education provided by primary schools and institutions of higher education institute.
- The prevailing opinion in society about the youth turning to agriculture was not so good.

Opportunity

- As many young people use smartphones, it is easy to get and share information related to agriculture.
- It is easy to share information related to agriculture as it is possible to identify new people through social networks through the internet.
- Facilitate the use of information technology to communicate in response to any issues related to agriculture.
- Despite the high demand for locally produced agricultural products.

Threat

- The reluctance of young people to engage in agriculture.
- Society despises young people for turning to agriculture.
- Lack of adequate internet facilities in some areas.
- Lack of proper communication between agricultural officers and growers.

7. RESEARCH FINDINGS AND SOLUTIONS

In this study, focused on the reasons why the young community in Sri Lanka does not pursue a career in agriculture and how to actively employ the youth population in Sri Lanka for the industry by resolving those stated issues. Data was gathered from around 100 young people in the Bulathsinhala region. The youthful community was chosen using a random sampling approach. The majority of the survey's participants were between the ages of 15 and 33. Our results are as follows, based on the data we gathered.

The bulk of our sample was between the ages of 23 and 26. As a percentage, it is 29.7 percent. We questioned their educational standing here. 36.8 percent had completed their education. 11.9 percent were postgraduates, whereas 18.7 percent were graduates. Diploma holders made approximately 22% of the ideal group. Only around 1% of them had completed grade 5 in school. As a result, it appears to us that virtually all the young individuals in our chosen group are well-educated. As a result, they recognize that disseminating knowledge about current technology is not a tough effort. When we met some young people here, we discovered that, while agriculture is taught in the Sri Lankan education system, it does not provide clear knowledge of how to put it into practice. Some of the young individuals we interviewed were agricultural graduates, but they are even more focused on finding a career in an agriculture-related field. They also have no intention of doing agriculture. As a result, we believe that agriculture education in Sri Lanka should be more practical.

We also inquired about the main occupation of their family. Some are engaged in business activities, and it was about 33.7% as a percentage. About 14.9% were engaged in agriculture. Thus, when we look at his family background, we see that many people do not like agriculture. It is clear from the above data that the focus is mostly on business.

Among the young people who answered this questionnaire, the majority of them, 61.4%, did not like agriculture. 38.6% said they would like to focus on agriculture. One of the main points that came to our notice here was the traditional societal view of agriculture. As more and more young people were reluctant to turn to agriculture, we looked at the main factors that prevented them from turning to agriculture. They commented as follows. The main reason why they did not turn to agriculture was that the way society looked at young people when they turned to agriculture was not good, it was difficult for them to make a profit from farming, even if they had problems related to farming, they did not have any mechanism to solve them. Thinking that doing things is a very difficult task. We found that they had problems with the nature of their parent's response to agriculture.

Here we inquired about the social perception of young people engaging in agriculture. A relatively large majority, 59% of the youth, said that the social opinion on farming was unsatisfactory. A very small percentage of 10.3% said that the social opinion of the youth about going to farming was very satisfactory. 30.8% percentage was slightly satisfactory. Thus, it seems that one of the main reasons why young people do not turn to farms is the social perception of farming. That is, if young people turn to farms, society will treat them as a low-value activity. We can hope that this problem will be largely solved if we can carry out agricultural activities using new technologies. Also, 48.4% of the respondents said that they would like to engage in new technology and agriculture. Also, 18.8% stated that they would do so and 32.8% stated that they have not made a proper decision in this regard. Thus, it is evident that many people in Sri Lanka would like to turn to agriculture if the use of new technologies instead of traditional methods is increasing.

Once a person is engaged in agriculture, he/she has the basic knowledge required to cultivate the crop, the cost of the cultivation, the selection of suitable land for the cultivation, the impact of the weather on the cultivation, if there is any problem with the cultivation. They were asked about their ability to seek advice. Many stated that it was difficult for them to gain a proper understanding of cultivation and to communicate with agricultural officials to resolve problems arising during cultivation. They also said that some people have a desire to cultivate but do not have the land to do so. They also did not have the confidence to sell their produce for a certain price after cultivation. Accordingly, it can be expected that if they can maintain good communication between the agricultural officers and the purchasers, the interest of the youth in agriculture will increase. This is because the youth community is very interested in a task only when they get the help, they need to carry it out. If not, they will abandon it.

When asked about the main media they use to get agricultural information, they said that Internet-related applications such as YouTube and Facebook and that agricultural officials obtain information from people such as Samurdhi officials.

There is currently a website to go over and get information about agriculture in Sri Lanka. But we could not identify an application to maintain good communication between the agricultural officers and the persons engaged in agriculture. The introduction of such an application will enable better communication between the people engaged in agriculture, the people who buy their produce, as well as the people who have vacant lands which are not cultivated, and the agricultural officers.

The introduction of such an application will modernize Sri Lanka's agriculture and increase the desire of young people to enter the industry. They will dispel society's underestimation of their focus on agriculture. It will also be able to do agriculture more efficiently when combined with new technology. Such an application will build very good communication between the cultivators and many people will be inclined towards cultivating.

7.1. Why young people do not turn to agriculture?

- The prevailing underestimation in the society of the youth towards agriculture.

- Lack of proper guidance to focus on agriculture.

- Lack of suitable media for obtaining agricultural information.

- Do not have land suitable for agriculture.

- Difficulty finding a suitable market to sell the harvest

7.2. Factors influencing the active involvement of youth in agriculture

- Getting proper training to focus on agriculture.
- Promptly obtain advice on issues related to agriculture and cultivation.
- Having a suitable IT-related medium to keep abreast of new trends in agriculture.
- Finding suitable land for cultivation.
- Easy availability of seeds and fertilizers required for cultivation.
- Improving inter-communication between farmers.
- Improving the relationship between cultivators and officials related to agriculture.
- Need real-time assistance to solve problems that may arise during cultivation.
- Need a regular market to sell the harvest.
- Increasing the use of new technology for agriculture.

7.3. Features of the mobile application

- Growers can gain an understanding of the current weather conditions in their area of residence.

- Understanding crop diseases and finding remedies for them.

- Easy purchase of seeds and raw materials required for cultivation.

- Growers can easily sell their produce at a higher price.

- Ability to obtain land for cultivators on a lease basis and to provide lands to cultivators on a lease basis.

- Provide an opportunity to discuss issues arising from agriculture.

- Ability to increase existing communication with people involved in agriculture.

- Availability of information on suitable crops for cultivation in the field.

- Ability to participate in courses to improve knowledge related to agriculture

7.4. Flow of the mobile application

Figure 3. Research design process

According to Figure 6.7.1, you need to register to use the mobile application. To register, you need to provide your name, address, etc. After registering, you will be able to sign into the app. You can also use Facebook login credentials when signing in. After logging in to the app, you will be taken to the home page. Its main menu is as follows.

- Rent or lease land.
- Weather report.
- Govisala (Products are very easy to sell).

- Information about economic centers.
- New Courses and Certificates in Agriculture.
- Presenting and answering problems related to agriculture.

7.4.1. Harvi Mobile Application features

When we are gathering data from youngers in the Bulathsinhala area, we sense that they have some barriers with using smart devices. At the time we share our questionnaire with them they couldn't fill it due to a lack of knowledge in using a smartphone. After we are analyzing the gathered data, we identified that most of the youngers using Facebook and YouTube applications. Besides that, they don't have much experience with their smart devices.

They were most familiar with functioning the Facebook app and YouTube app. By considering those factors, we could be able to identify the user's experience with their smart devices. Hence, we used the same functions on Harvi Mobile Application, that Facebook and YouTube applications are using. The application name "Harvi" came with the word "Harvest". we proposed this application based on the young farmer's experience with their smart devices. we build this app by mainly focusing on the young farmers in Sri Lanka. Harvi comes with 7 main features.

They are,

1. Land lease & rent
2. Weather Forecast
3. Economic center
4. Govisala
5. Courses
6. Q & A
7. Harvi Messenger

7.4.2. User Interfaces
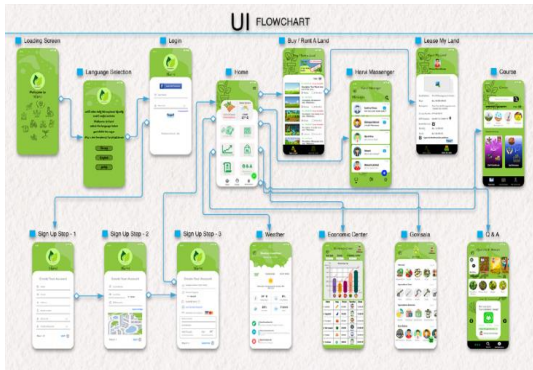#### 7.4.2.1. Harvi Welcome page
When youngers interacting with mobile applications the main problem, they are facing is the language.

We realize that most of the youngers have difficulties with the English language when we

hand over the questioner. Harvi contains Sinhala, English, Tamil languages. So, people don't need to worry about language barriers. Also, users can change the language at any time in the application settings.

7.4.2.2. Sign-in & sign-up page

To use this application user must register first. In the registration process app will collect

- Personal details - User Name, E-mail, Address, Mobile Number, Password (App password must contain 8 characters long, at least 1 upper case letter, 1 lower case letter, number)
- Land details – Land address, Land size (can be entered in Acres & Perches), GPS location, Lease land (we are asking user that Are you willing to lease the land on the app using a checkbox)
- Bank & transaction details – Company name / Seller name, Current progress (farming, learning, looking for land, working), Link bank account, Debit card / Credit card details (Visa, Master card users)

In the sign-up process, the user can have detailed instructions in any uncleared field. Users can have this feature by clicking on the desired text or long pressing on it.

Personal details are required in the sign-up process. Bank details & transaction details or land details can be skipped. By skipping those some features may unavailable. Users can enter that skipped information at any time in their profile settings.

In the sign-in process hence most of our targeted users have Facebook accounts, we added a feature that users can log in with Facebook. By using this feature users don't need to enter their details but bank details & land details. Bank details and Land details can be skipped in the sign-up process.

In case of users forget the password, they can simply reset it by clicking on the "Forget password". In that process, the app will send a server-generated code to the user's mobile number or email. By entering it user can complete the reset password process.

7.4.2.3. Home page

We designed the homepage that any user can identify the features by simply looking at the icon rather than reading the feature. We mainly focused on icon base feature identification all over the app.

7.4.2.4. Weather report page

Users can access the weather report page by simply clicking on the weather summary. On this page, users can have real-time updated information about temperature, precipitation, humidity, wind speed, and what crops grow successfully under the current weather.

7.4.2.5. Lease and rent land page
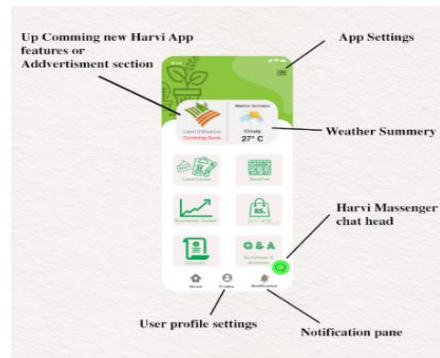
Figure 4. Lease and rent land

On this page, users can lease or rent their lands with a click. In this process, some verified documents must be scanned and uploaded due to security and legal purposes. Also, farmers can post their land advertisements in the "Top Add" section but with a small payment. This feature will help them to sell their land quickly.

In the posting advertisement process, the app will collect the below data.

Land image (can be uploaded up to 4 images), Land address, Land price, Land description (500-word limit), Land GPS location coordinates

By entering the land value, the app will automatically generate the monthly and yearly payments to lease. There are some terms and conditions in this process due to security and legal purposes.

7.4.2.6. Govisala page

Govisala is for buy agriculture-related tools, materials, fertilizers, pesticides, insecticides, other chemical materials, and vegetables, fruits, seeds, beans, rice, spice, and many more harvesting materials. In the best seller section, users can identify the verified sellers and most sales sellers. Also, users can buy from them. Users can pay for their selected goods in the cart. By clicking the back button, it will land on the home page. The cart will remain until the user removes the items or pay for them. Users can get back to the cart at any time the app will automatically save the current progress and shop items.

7.4.2.7. Economic market page

Farmers can sell their products and get in touch with the current market price in agriculture-related crops. In the selling, their product process farmers can select the district and desired economic center related to the selected district. All they need to do is deliver the goods on time. In this process, the app will hold the money due to security purposes. Money will be on hold till the buyer verify that the goods are received. Users can easily get information by simply looking at the price chart. This chart will show the product price per 1 kilogram.

7.4.2.8. Courses page

Users can follow free courses or pay once. after completing the courses, they can collect their electronic certificates in the certificate section of the app. In the "My course section" users can get access to their enrolled courses. Users can search for any course by typing the keyword on the search bar or by selecting the category. Theirs a course filter option to select whether it's a paid or free course, select the course time, free certificates.

7.4.2.9. Q & A page

Users can post agriculture-related questions to find answers. So, the fellow farmers can provide solutions for them. Also, users can post a 24-hour status just like the Facebook status and others can comment on it. In the diseases section, users can search for any disease by helping with the filter. Users can move on to the next post by swiping the post. By clicking the "I have this question too" button users can get a brief idea about that

how many users facing the same question. This button will help find a correct solution for their questions and also prevent the different users from posting the smiler questions.

7.4.2.10. Harvi messenger

Most of the young farmers are using Facebook. So, the Harvi messenger is functioning the same as the Facebook messenger. this will help farmers to get in touch with their fellow farmers and share their information. Harvi messenger exactly same as the Facebook messenger but with some extra features. We added the detailed location share feature hence this app is related to the large scale of lands. Harvi messenger has the chat head option. This feature will help to chat with others while doing other work on the phone. Even a user exit the app Harvi messenger will run in the background with a chat head just like the Facebook messenger app chat head. This feature will help farmers to get in touch with their fellow farmers.

8. CONCLUSION

Agriculture plays a crucial role in economic life. It is the backbone of the economic system. Agriculture provides employment not only for food and raw materials but also for a large section of the population. Due to the lack of up-to-date information, farmers do not reap the maximum benefits from their cultivation. Today, the mobile application is the easiest way to access information for any industry. However, very few farmers in Sri Lanka use this new technology. Another problem is the declining participation of young people in agriculture. Therefore, the objectives of this study were to find out the reasons why Sri Lankan youth are not engaged in agriculture and to answer them using information technology.

Data were collected from 100 youths in Bulathsinhala, and the youth community was selected by random sampling. As a result of these questions, 61.4% percent disliked agriculture, and 38.6% preferred to focus on agriculture. Also, 48.43% said they would like to engage in new technology and agriculture. This shows that many people would like to enter the agriculture

industry if the use of new technology instead of traditional methods increases.

Based on previous studies, there are several reasons why young people are reluctant to engage in agriculture. The main reason why young people do not turn to agriculture is the social understanding of agriculture. At the same time, the low value of agriculture in society prevents them from resorting to this. Another factor is the lack of a good market for agricultural products. These problems can be largely solved if agriculture can be done using new technology.

To maintain good communication between agricultural officers and people engaged in agricultural activities, it is more appropriate to introduce an application form containing agricultural information. This mobile application is which contains features of Facebook and YouTube. Growers can gain an understanding of the current weather conditions in their area of residence, understanding crop diseases and finding remedies for them, and easy purchase of seeds and raw materials required for cultivation are some features in this application. Growers can sell their produce directly to consumers without the use of intermediaries, Easy access for raw materials for growers and provide the opportunity to cultivate barren lands, are the benefits of the purposed application. Also, implement a proper land utilization system for smart agriculture is the future implementation of this application. The introduction of such an application in agriculture as a solution to the problems we found in this research will increase the desire of the youth of Sri Lanka to enter agriculture.

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Online Student Engagement and Satisfaction During the Covid-19 Pandemic Situation

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ABSTRACT

Since the education is considered as a very significant factor for any nation-state the continuation of the education is also very crucial even in this global pandemic situation. The delivery method of fully online mode is increasing as a result of the global pandemic, and it has become the leading delivery method in every aspect of education. The conduct of lectures and the related practical's, assessments, practical tests and final examinations are also having to conduct by using only this online mode. The objective of this study is to examine the most influential students' engagement factors which impact on student satisfaction in online delivery mode. The conceptual framework was comprised with the independent variables of Students' Performance, Level of Practising, Regular Participation in online classes and dependent variable of Online Satisfaction. The advantage of Time due to the learning online from home concept and the Students' Skills based on technological perspectives were being tested for the mediation effect for this conceptual model. The self-administered questionnaire was used as the research instrument and quantitative approach was followed to analyse the derived hypotheses based on the research questions and the objectives. The target population for this course was 714 which was the registered number of students for this study and target sample size was 248.The primary data collection was comprised with the valid sample of 268 regular present undergraduate students in online sessions. Statistical data analysis was based on Partial Least Square Structured Equation Modelling

(PLS-SEM). The analysis was based on the Measurement Model and Structural model. The bootstrap results revealed that all the relationships were statistically significant. The Path values and significance (where P must be less than 0.05) of the relationships were: Learner skills → Online Satisfaction (0.208,P=0.013), Participation → Performance (0.490,P=0.000), Performance → Learner skills (0.620,P=0.000), Performance → Online Satisfaction (0.332,P=0.000), Performance → Time (0.612,P=0.000), Practicing → Performance (0.382,P=0.000) and Time → Online Satisfaction (0.258,P=0.000). The values of VAF (Variance Accounted For) which are based on the strength of the mediation effects and the mediation through Skills is 28% and mediation through Time is 32%. The rule of thumb the VAF are in between (20% - 80%) and it could be characterized as a typical partial mediation. The R^2 values of the Learner skills (38%), Online Satisfaction (47%), Performance (58%) and Time (38%). The future research must be conducted with a larger sample by combining other subjects and longitudinal method will follow to get more insight of the students' achievements and find out more dimensions of students' engagement since R^2 can be improved for each variable. It is recommended that online teaching and learning must be performed by both learner and teacher with high dedication and more trustworthy way to reach the targets.

Key Words: Performance, Practising, Participation, Time, Online Satisfaction, Students' Skills

1. INTRODUCTION

Due to the Covid-19 Pandemic situation as other organisations, educational institutes also have been closed all over the world. The continuation of the education field also has the only option was online learning and teaching in nationally and internationally. The students were struggling to come out successfully from this situation with their technical supportive things such as laptops, desktops, tabs, and least option was the smart phones. However not only students the teachers also responsible with their students to fulfil the technological knowledge gaps (García & Weiss, 2020 September 10). No one can't solve this ridiculous situation and individuals must find efficient solutions by enhancing technological gaps. With this pandemic, online learning has become even more widespread as it is considered to be the sole solution to provide education by keeping social distance and lockdown all around the world (Dembereldorj, 2021). Student engagement persists critical to learning and achievement and the educators need to find new procedures to engage and inspire their students in online mode of teaching. The importance of student engagement cannot be underestimated, and it's effects of student success of future, and significantly help out to close COVID-19 learning gaps (Thorsteinsen, Parks-Stamm, Olsen, Kvalø, & Martiny, 2021).

1.1 Background of the study

Student engagement can be defined according to Sousa in 2016 "the amount of attention, interest, curiosity, and positive emotional connections that students have when they are learning whether in the classroom or on their own" (Sousa, 2016, p. 17). This concept has been conceptualized in numerous ways (Farrell & Brunton, 2020; KoobI, Schropfer, Coenen, Kus, & Schmidt, 2021; Thorsteinsen, Parks-Stamm, Olsen, Kvalø, & Martiny, 2021; Toth, 2021) amongst the researchers in worldwide. The key idea is behind this concept has hypothesized by identifying the significant relationships between individual attitudes, thoughts, behaviour, communication with each other, time spent, content, the level of interaction between the teacher, learners' skills, participation in the online lectures, performance, and emotions of the students. The widely applied theories of Community of Inquiry model (Garrison, Anderson, & Archer, 2010) and social construction theories (Vygotsky, 1978) have based on the this empirical research (Dixson, 2015). The research Gap identified for this study was there were very few studies have been conducted for ODL system during this Covid-19 pandemic period to uncover the student wellbeing with the online day schools, practical classes, and assessments.

1.2 Research Problem Identification

The symptoms and justification of the problems encountered in online learning and teaching were identified during the online sessions. Most of the students were suffering with the technological gaps (digital divide) and they have no internet facilities to join online classes. The availability of the computers with the minimum facility of smart phones also a problem with students who relates to lower income household families. Some equipments ownership was with someone else or students' have hired them. Then they don't have enough time to spend for practising without a proper instrument. This problematic stage was uncovered through a survey conducted in each online class and discuss with the students to give at least very lower-level solutions to their existing problems in different directions. The awareness of the keyboard and the speed need to work with them were motivated through the typing tutorials. With the surveys conducted during the online classes could be justify the problematic environment with the students. Students' performance, Regular practising, Students' Skills, regular participation in the online classes were identified as very critical factors for the students' wellbeing and the online learning satisfaction. And also, it was identified the time spent by the students for their lessons and their technological skills were very helpful in their performance and understanding

level and it was directly affect for their gradings in mock exams and final gradings.

1.3 Research Questions

Following research questions were derived from the problem statement.

1. Is there any significant impact of Students' Regular Participation on Students' Performance in online learning platform?
2. Is there any significant impact of Students' Level of Practising on Students' Performance in online learning platform?
3. Is there any significant impact of Students' Performance on Students' Online Satisfaction in online learning platform?
4. Are there any mediation effects of Learners' Skills and Cost and Time on Students' Online Satisfaction in online learning platform?

1.4 Objectives of the Study

The general objective is to elucidate the significant factors which impact on Students' Performance, Online Satisfaction, and existence of the mediation effect between Time and Cost and the Learners' Skills in their online education platform.

The Specific research objectives are;

1. To find the significant impact of Students' Regular Participation on Students' Performance in online learning platform?
2. To find the significant impact of Students' Level of Practising on Students' Performance in online learning platform?
3. To find the significant impact of Students' Performance on Students' Online Satisfaction in online learning platform?
4. To find the mediation effects of Learners' Skills and Cost and Time on Students' Online Satisfaction in online learning platform?

1.5 Significance of the Study

Due to the prevailing situation of the world, the education sector has faced very challengeable situation with its two main processes of teaching and learning. Online learning and teaching are in progress worldwide but mainly students are facing very flexile situations to very sympathetic situations due to the available facilities with them.

The evaluation process also must be continued without any disturbances to passed out the graduands. The students' experience with online day school series and their online practical classes will directly affected to face online examinations successfully. To continue this situation until reached to a Covid free environment by setting up innovative and successful strategies for the wellbeing of the prospective students. The research findings will be more valuable to make necessary policies to the higher Management decision makers to reduce the digital divide among the potential students at least in a reasonable level.

1.6 Limitations of the Study

With this study it was considered only the mean value of the actively participated students in the scheduled online day schools and online practical classes since the attendance is not compulsory, all the registered students did not attend the online sessions. This study was limited only for one course of the First year of the Degree program. The availability of the internet for the individuals also a limitation since some of the remote students were not able to get their internet facilities during the lockdown period.

2. RESEARCH METHODOLOGY

In this section Conceptual Framework for the study, Operationalization of the variables, Research Design and Data Analysis will be discussed.

2.1 The conceptual framework

The conceptual framework was focused on the literature based on student engagement before and during the Covid-19 pandemic (Dembereldorj, 2021 ; Dixson, 2015) and the experience gained from more than nine months

by conducting surveys in the online day schools and online practical sessions during the Covid-19 period. This model was evaluated to check whether there exist the following three relationships. The first relationship, between Dependent variable of Students' Performance and Independent variables of Level of Practising and Regular Participation in online classes. The second relationship is the Dependent variable of Students' Online Satisfaction and the Independent variable of Students' Performance. The third relationship is mediation effect between Advantages of Cost and Time due to the online learning from home and the Students' Skills based on technological perspectives.
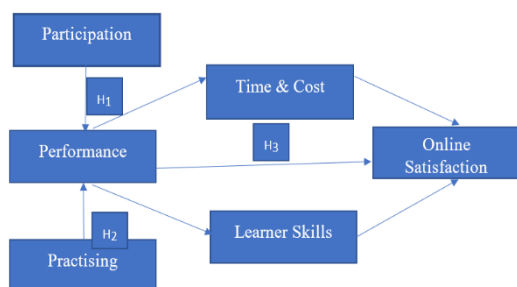

Figure 1. Conceptual model for the study

2.2. Research Hypotheses

The following seven Hypotheses were examined to find the solutions to the research questions and the objectives. The Alternative(A) and Null (0) hypotheses are shown below.

1. The Alternative(A) and Null (0) hypotheses to test the relationship between Students' Participation and Students' Performance
H_{1A}: There is a significant impact of Students' Participation on Students' Performance
H_{10}: There is no significant impact of Students' Participation on Students' Performance

2. The Alternative(A) and Null (0) hypotheses to test the relationship between Students' Level of Practising and Students' Performance
H_{2A}: There is a significant impact of Students' Level of Practising on Students' Performance

H_{20}: There is no significant impact of Students' Level of Practising on Students' Performance

3. The Alternative(A) and Null (0) hypotheses to test the relationship between Students' Performance and Students' Online Satisfaction
H_{3A}: There is a significant impact of Students' Performance on Students' Online Satisfaction H_{30}: There is no significant impact of Students' Performance on Students' Online Satisfaction

4. The Alternative(A) and Null (0) hypotheses to test the mediation effects of Learners' Skills and Cost and Time on Students' Online Satisfaction
H_{4A}: There are mediation effects of Learners' Skills and Cost and Time on Students' Online Satisfaction
H_{40}: There are no mediation effects of Learners' Skills and Cost and Time on Students' Online Satisfaction

2.3. Operationalization of the Variables

The operationalization of the independent and dependent variables are in the Table 1. The research instrument of the self-administered questionnaire will be based on this operationalization.

Table 1. Operationalization of the Variables

Concept	Source	Operational Component	Measurement Scale
1. Participating: Which is an indication of the level of participation in the scheduled day schools and practical classes on time, preparing the lectures with the updating the knowledge by login virtual classes and other relevant websites.			
Partici1	(Dixson, 2015)	Normally participate in all lectures scheduled in the Master Timetable	Likert scale (1..5)
		Always refer the course material and prepare for the lectures	
Partici2		Always concern the starting time of the sessions and try to login before that time	
		Join with a very happy mood in my online lectures regularly	
Partici3		Login to virtual online class regularly to get to know the updates	

Concept	Source	Operational Component	Measurement Scale
Partici4		With the regular basis login to faculty website to get the updates With the regular basis login to virtual online class to get the updates	
Partici5			
Partici6			
Partici7			

2. Performance : Which is an indication of the level of the performance of individuals while learning online, CATs and the Practical tests				
Concept	Source	Operational Component	Measurement Scale
Performance1	(Dixson, 2015)	Prepare short notes for each lesson to ease study path	Likert scale (1..5)
Performance2		Always try to run programmes in the device whatever available	
Performance3		Try to do best in preparing tests	
Performane4		Try to do my best in my continuous assessment tests (CATs)	
Performance5		Try to get higher grades for my subjects	
Performance6		Use EFIL sessions very effectively to success the examinations	
Performance7		Try best and hope to do a special degree	

3.Practising: Which is an indication of the level of practice with the computer programmes to get more knowledge and experience				
Concept	Source	Operational Component	Measurement Scale
Practice1	(Dixson, 2015)	Installed required software by following the instruction given before stating the course	Likert scale (1..5)
Practice2		Understood it is necessary to have good typing speed and important to practice with the given typing tutor Try to execute all the programs in my textbook and Practical Guide	

Concept	Source	Operational Component	Measurement Scale
Practice3		Try to modify those programs as I wish and compare the results.	
Practice4			

4.Time: Which is an indication of the saving of the Time due to the learning from home and can be saved the expenses and utilise more time for the studies without wasting transport				
Online1	(Dixson, 2015)	Understand now can save more time with online learning Aware that more time can spend for studies during the pandemic period at home	Likert scale(1..5)
Online2		Try to allocate my maximum time to revise the lessons	
Online3			

5. Learners' Skills: Which is an indication of the level of Skills must have or to improve by the students to follow up the online lectures.				
Skills1	(Dixson, 2015)	Can easily manage my internet connection charges to do all my online lessons	Likert scale(1..5)
Skills2		Need good knowledge of internet to handle online classes I have enough knowledge of internet to work online	
Skills3		I try to improve online learning tools such as Zoom, Teams	
Skills4		Try to improve typing skills with typing tutors such as Kiran typing tutor	
Skills5		Try to improve subject knowledge by referring to given online videos and lesson materials	
Skills6			

6. Students' Online Satisfaction : Which defines that how students' are satisfying their lecture series to face the CATs and Final examinations competently				

Concept	Source	Operational Component	Measurement Scale
Study1	(Researcher)	Satisfied with my course materials and Practical guides following	Likert scale (1..5)
		Satisfied with the online practical classes	
Study2		I satisfied that how step by step explained in the course material	
Study3		I satisfied the online lectures conducted up to now	
Study4		Can be satisfied the way clarify doubts by asking questions during the online sessions	
Study5		Online lectures are better than face to face	
		Face to face lectures are better than Online lectures	
Study6			
Study7			

2.4. Research Design

2.4.1. Unit of Analysis

This refers to the data collection and analysis stages for the data aggregation. The unit of analysis is defined by the individuals of this study (Sekaran & Bougie, 2010).

2.4.2. Time Horizon

This study will be conducted as a cross sectional study in the presence of the students in the online sessions (Ali, Zhou, Hussain, Nair, & Ragavan, 2016; Saunders, Lewis, & Thornhill, 2011).

2.4.3. Research approach

The deductive approach was followed, and testable hypotheses will be narrow down by prescribing the relationships between two or more variables. The hypotheses will be tested by using statistical methods and "Generalisation" of the results can be done for the population by effectively generating sufficient numerical size of the sample by using statistical inferences (Saunders, Lewis, & Thornhill, 2011).

2.4.4. Justification of Research Philosophy

The research Philosophy of Positivism is followed with this study. It is usually linked with natural science research and experimental testing. This study also based on empirical testing to accept or reject the hypotheses in deductive approach (Easterby-Smith, Thorpe, & Jackson, 2012).

2.4.5. Selection of target Population and Sample Size

The Target population was the number of registered students (714) for this course and the sample size must be 248 (Krejcie & Morgan, 1970). Since in ODL system the attendance of the day schools and practical day schools are not compulsory, in generally 60% of the students were present in online sessions. The random sample was selected from the regular students. The valid sample size for this study was 268 of the selected population.

2.4.6. Survey Instrument And Data Collection

The survey instrument was developed based on the literature review and self-administered questionnaire was designed with the 5-point Likert Scale (Man, 2012).In this research study, the five-point Likert scale was applied where 1. Strongly Disagree, 2. Disagree, 3. Neither Disagree nor Agree, 4. Agree, and 5. Strongly Agree. The questionnaire was based on the Operationalisation of the Variables and it was consisted with 34 questions The data collection was done through the online by using Google forms.

2.4.7. Data Analysis

Multivariate analysis consists of statistical methods that can analyse multiple variables simultaneously. Multivariate methods are divided in to two generations, called first generation and second generation The main objective of multivariate techniques is to increase the researcher's statistical competence and explanatory ability (Hair, Black, Babin, Anderson, & Tatham, 2011, p. 729). It is mainly useful in testing theories that contain multiple equations involving dependence relationships.

With some cases, hypothesised dependent variable becomes an independent variable in the consequent dependence relationship.

None of the first-generation techniques support this type of measurement properties. Structured Equation Modelling (SEM) will be very useful to solve this type of situations (Hair, Ringle, & Sarstedt, PLS-SEM: Indeed a Silver Bullet, spring 2011, p. 730).

Path models are visually displayed diagrams used to represent the relationships among variables and hypotheses that are examined by using SEM. The constructs that are not directly measured are represented in the path model as circles.

The indicators (items) can be measured directly and contains the raw data. They are represented by rectangles in the path diagram. Relationships are shown by arrows between the constructs and their indicators. In PLS-SEM, single headed arrows are used as directional relationship. Furthermore, the arrows are considered as "predictive relationships with strong theoretical support that can be interpreted as causal relationships" (Hair, Hult, Ringle, & Sarstedt, 2017, p. 17) .

There are two main elements in the PLS-SEM path model, namely inner model and outer model. The measurement model or outer model describes the relationships between the latent variables and their indicators. The Structural model or inner model describes the relationships between the constructs.

The systematic evaluation process supports the assessment of the relationships between the constructs and their indicators using measurement model. Also, between the constructs which will be covered through the structural model. Furthermore, the empirical measures will provide the support to test and compare with the theoretically established data and the reality of the structural model by using the sample data. "The goal of the PLS-SEM is to maximize the explained variance (R^2 value) of the endogenous variables in the path model" (Hair, Hult, Ringle, & Sarstedt, 2017, p. 105) .

3. DATA ANALYSIS AND THE RESEARCH FINDINGS

The pilot test was carried out with 50 students. The variables and their no. of items, Cronbach's Alpha values are tabulated in the Table 2

Table 2 Pilot test data analysis

	Constructs	Cronbach's Alpha	No. of Items
1.	Participation	0.746	7
2.	Performance	0.741	6
3.	Skills	0.676	6
4.	Practising	0.732	7
5.	Time	0.679	8
6.	Online Satisfaction	0.612	8

The validity and reliability tests could be considered as the main evaluation methods of the measurement instrument and Cronbach coefficient alpha is the most widely used test for reliability analysis (Fields & Bisschoff, 2014). Validity is concerned to what extent an instrument measures that intended to measure and Reliability is the ability of an instrument to measure consistently (Tavakol & Dennick, 2011). The Cronbach-Alpha values of all the constructs were more than 0.6 and can be considered as acceptable level (Hair, Ringle, & Sarstedt, PLS-SEM: Indeed a Silver Bullet, spring 2011, p. 161) . Initially, to establish the content validity of the questionnaire, it was tested with an expert and a group of experts to comment of the appropriateness and representativeness of the questions to avoid unnecessary problems to the selected sample of the population. To check the face validity, the questionnaire was given to two educators to check whether the questionnaire made sense (Saunders, Lewis, & Thornhill, 2011).

3.1. Demographic analysis of the Sample

The 70% of the sample was consisted with the age between 18-25 years and 25% was represented by the age between 26-30 years. The 78% of the sample was comprised by the females. The 61% of the students were not

employed. The 86% of the students were used their own computers and 14% have not used their own. The maximum percentage 48% of the students have used Smart phones to connect with the online sessions while Desktop used (46%), Laptop (5%) and remain (1%) have used Tablets.

3.2. **Evaluation of the Conceptual Model**

This model was evaluated against the Measurement Model by evaluating the outer loadings of the items of the construct. The reflective measurement model was analysed through the outer loadings of the constructs in the outer model of the conceptual framework. The outer model of the conceptual framework was consisted with the independent and dependent variables and their reflective indicators. The outer loadings which are less than .708 should be removed by examining the effect of the item removal compared with the Composite Reliability (CR) and Average Variance Extracted (AVE).

Generally, the outer loadings between .4000 and .7000 should be considered for removal from the measurement model when it leads to an increase of CR and AVE above their threshold values (CR; 0.60-0.90 and AVE>0.50). However, the items which are less than .4000 should be eliminated from the construct (Hair, Hult, Ringle, & Sarstedt, 2017). All the cross loadings are in highlighted colour. All of the highlighted values are greater than the other values in the rows and the columns.

Table 3 shows all the cross loadings in the highlighted colour

Constructs	Time	Participation	Performance	Practising	Learner skills	Online Satisfaction
Online1	0.588	0.254	0.259	0.250	0.338	0.388
Online2	0.791	0.409	0.442	0.250	0.372	0.394
Online3	0.820	0.571	0.595	0.381	0.470	0.485
Partici1	0.406	0.651	0.520	0.391	0.454	0.433
Partici2	0.513	0.650	0.562	0.427	0.450	0.419
Partici3	0.406	0.671	0.456	0.336	0.373	0.466
Partici5	0.403	0.800	0.507	0.371	0.388	0.469
Partici6	0.349	0.745	0.439	0.350	0.299	0.436
Partici7	0.400	0.787	0.445	0.334	0.302	0.456
Performance 5	0.551	0.550	0.785	0.427	0.452	0.462
Performance1	0.398	0.450	0.782	0.555	0.430	0.499
Performance2	0.324	0.471	0.722	0.469	0.393	0.449
Performance3	0.519	0.514	0.719	0.404	0.499	0.462
Performance6	0.424	0.534	0.654	0.335	0.421	0.359
Performance 4	0.435	0.489	0.698	0.581	0.500	0.463
Practice1	0.274	0.390	0.379	0.638	0.260	0.333
Practice2	0.249	0.286	0.379	0.625	0.271	0.348
Practice3	0.309	0.432	0.556	0.801	0.386	0.373
Practice4	0.326	0.369	0.479	0.778	0.355	0.413
Skills3	0.249	0.275	0.332	0.278	0.642	0.340
Skills5	0.444	0.426	0.483	0.293	0.708	0.320
Skills6	0.470	0.464	0.535	0.412	0.851	0.533
Study1	0.378	0.414	0.389	0.379	0.384	0.649
Study2	0.481	0.534	0.505	0.392	0.430	0.842
Study3	0.441	0.492	0.464	0.421	0.421	0.806
Study4	0.529	0.573	0.550	0.418	0.478	0.879
Study5	0.425	0.442	0.523	0.418	0.465	0.761

3.2.1. **Evaluation of the Construct Reliability and validity**

The criterion for internal consistency is Cronbach's alpha, which provides an estimate of the reliability based on the inter correlations of the observed indicator variables. This is very sensitive to the number of items in the scale. All the Cronbach's alpha values are around .700 and can be considered as "good".

Another, technically more appropriate measurement approach of internal consistency reliability is Composite Reliability. The common minimum threshold value for Composite Reliability is .700 but should be less than .95 . All values in Composite reliability have exceed the threshold value and have reached the required level of internal consistency reliability

Two ways of evaluating the convergent validity of reflective constructs are the outer loadings of the indicators and the Average Variance Extracted (AVE). The square value of the size of the outer loadings is called indicator reliability. AVE is equivalent to the communality of a construct. AVE value of .50 or higher indicates that the construct has explained half of the variance of its indicators (Hair, Black, Babin, Anderson, & Tatham, 2011, p. 115).

Table 4 The Construct Reliability and Validity of the constructs

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Learner skills	0.683	0.625	0.780	0.546
Online Satisfaction	0.848	0.858	0.892	0.626
Participation	0.812	0.810	0.865	0.518
Performance	0.822	0.824	0.871	0.530
Practising	0.680	0.704	0.805	0.511
Time	0.688	0.630	0.781	0.548

3.2.2. **Discriminant Validity**

"Discriminant Validity" is the extent to which a construct is truly distinct from other constructs by empirical standards. First approach of the discriminant validity is cross loadings. In the Table 5 is shown, rows represent the values of indicators and columns represent the constructs. With reference to each construct, the values of the indicators show that loadings are exceeding the cross loadings. That indicates the Discriminant Validity has been established.

The second approach of assessing the discriminant validity is the Fornell-Larcker criterion. It compares the square root of the AVE values with the latent variable correlations. The square root of each construct's AVE values of each variable should be greater than its highest correlation with any other construct. Table shows the square root of each construct's AVE values on the diagonal and other non-diagonal values which represent the correlations of other constructs. It can be compared with the same row or with the same column for the establishment of the discriminant validity.

Table 5 The discriminant validity

	Learner skills	Online Satisfaction	Participation	Performance	Practising	Time
Learner skills	0.739					
Online Satisfaction	0.552	0.791				
Participation	0.536	0.624	0.720			
Performance	0.620	0.619	0.689	0.728		
Practising	0.452	0.512	0.519	0.637	0.715	
Time	0.538	0.573	0.583	0.612	0.406	0.740

The third approach of the assessing Discriminant Validity is Heterotrait – Monotrait ratio (HTMT) where the threshold value of 0.90 suggests lack of discriminant validity (Hair, Hult, Ringle, & Sarstedt, 2017, p. 122). All the values in the Table 5 are less than .90 and can be concluded no discrimination issues.

Table 6 The discriminant validity; heterotrait – monotrait ratio

	Learner skills	Online Satisfaction	Participation	Performance	Practising	Time
Learner skills						
Online Satisfaction	0.768					
Participation	0.751	0.749				
Performance	0.878	0.738	0.833			
Practising	0.695	0.680	0.688	0.838		
Time	0.889	0.807	0.792	0.833	0.629	

3.3. **Evaluation of the Structural Model**

Table 7 VIF values

	Learner skills	Online Satisfaction	Participation	Performance	Practising	Time
Learner skills		1.738				
Online Satisfaction						
Participation				1.369		
Performance	1.000	1.975				1.000
Practising				1.369		
Time		1.712				

Once the measurement model results were confirmed, the structural model was analysed with the PLS-SEM algorithm in order to produce the values of the reflective and formative paths. The bootstrap procedure was applied to get the significant results of the path co-efficients (P-values).

The significant relationships between the constructs are determined by the value of P which is less than or equal to zero (5%; two-tailed test) and empirical t-value is above 1.96 (Hair, Hult, Ringle, & Sarstedt, 2017, p. 153)

Structural model assessment procedure comprises with Collinearity issues with Variance Inflation Factor (VIF) which is followed by the estimation of the Path Co-Efficients in the structural model and assessment of the R^2.

Table 8 The path values of the relationship

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Learner skills -> Online Satisfaction	0.208	0.208	0.085	2.450	0.014
Participation -> Performance	0.490	0.495	0.047	10.365	0.000
Performance -> Learner skills	0.620	0.624	0.039	15.751	0.000
Performance -> Online Satisfaction	0.332	0.334	0.073	4.536	0.000
Performance -> Time	0.612	0.616	0.040	15.487	0.000
Practising -> Performance	0.382	0.381	0.047	8.174	0.000
Time -> Online Satisfaction	0.258	0.258	0.070	3.668	0.000

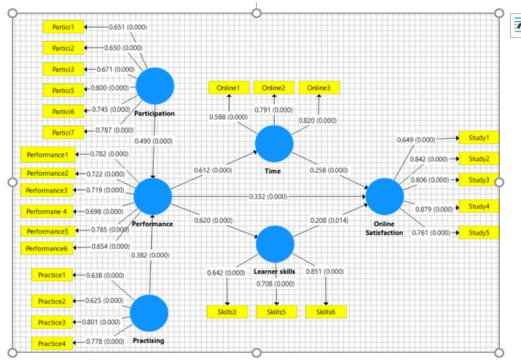All the paths of the Final structural model were significant (p< .05).

Figure 1. The structural model

3.3.1. **The Collinearity assessment is done with Variance Inflation Factor (VIF)**

The critical level of Collinearity is measured with VIF value is above 5. The evaluated VIF values are tabulated and all the VIF values of dependent and independent variables are below the threshold value of 2. It can be concluded that no multicollinearity issues with this structural model.

3.4. **Quality Criteria**

The R^2 value which represents the coefficient of determination use to measure the predictive power of the model. The R^2 value ranges from 0 to 1 and higher levels represents the high level of predictive accuracy.

Normally in research as a rule of thumb for endogenous variables the values of 0.75, 0.50 and 0.25 described as substantial, moderate and weak respectively (Hair, Hult, Ringle, & Sarstedt, 2017).

3.5. **Evaluation of the Mediation effect of Time and the Skills**

Instead of Sobel test (Sobel, 1982) for mediation effect in the context of Smart PLS, the Bootstrapping procedure was applied. Mediation analysis required a series of analyses of the significance of the direct and indirect effects.

Depending on the strength of the relationship, mediation and non-mediation effects can be distinguished (Hair J. F., Hult, Ringle, & Sarstedt, 2017).

The bootstrapped results for the direct, indirect and total effects are significant ($p < 0.05$) since the 95% bootstrap confidence intervals did not include zero.

The factor of Variance Account For (VAF) determined the size of the indirect effect in relation to the total effect (direct effect + Indirect effect).

VAF= Indirect effect / (Total effect)

The calculated values for the VAF for Time is 0.322440 and VAF for Skills is .279826. So, it can be concluded that there are positive mediation effects between Students' Performance and the Student's online Satisfaction through the Time and the Skills.

3.6. **Evaluation of the Hypotheses**

All the Alternative hypotheses have been accepted with (95%) confidence interval.

Table 9 R^2 values

		R Square	R Square Adjusted
Relationship	Hypothesis	Path values Significant (p< 0.05)	Significant relationship (Y/N)
Participation -> Performance	H1A: There is a significant impact of Students' Participation on Students' Performance	0.490 (0.000)	Yes H1A accepted
	H10: There is no significant impact of Students' Participation on Students' Performance		H10 Rejected
Practising -> Performance	H2A: There is a significant impact of Students' Level of Practising on Students' Performance	0.382 (0.000)	Yes H2A accepted
	H20: There is no significant impact of Students' Level of Practising on Students' Performance		H20 Rejected
Performance -> Online Satisfaction	H3A: There is a significant impact of Students' Performance on Students' Online Satisfaction	0.332 (0.000)	Yes H3A accepted
	H30: There is no significant impact of Students' Performance on Students' Online Satisfaction		H30 Rejected
Performance-> Time & Skills -> Online Satisfaction	H4A: There are mediation effects of Learners' Skills and Time on Students' Online Satisfaction	All paths are significant (Figure 4.1)	Yes H4A accepted
	H40: There are no mediation effects of Learners' Skills and Cost and Time on Students' Online Satisfaction		H40 Rejected

Table 10 Evaluation of the Hypotheses

4. DISCUSSION, RECOMMENDATION AND FUTURE RESEARCH

The Discussion and recommendation will be based on the research findings of this study

4.1. Discussion of the Research Findings

All the Paths of the Conceptual model were significant, and Figure 4.1 can be concluded as the final model for this study. All the alternative hypotheses were accepted with the 95% confidence interval. The answers for the research questions and all the objectives can be fulfilled through the support of the hypotheses.

The objectives of the significant impact of Students' Regular Participation, Level of Practising, Students' Performance on Students' Online Satisfaction in online learning platform were confirmed with positive significant impact. It was proved that there is a mediation effects of Learners' Skills and Cost and Time on Students' Online Satisfaction in online learning platform. The research findings of (Dixson, 2015)is how ever consistent with these results but the two mediation effect in this study is novel to this study.

4.2. Recommendations and Future Research

The students must be motivated through at least with student loans to get computers to carry out the learning process without any disturbances.

The availability of high-speed internet access is the most noteworthy factor for students and tertiary education institutes, or government must offer such facilities at least to a concession rate to continue their online sessions without any technical deficiencies.

The alternative methods must be provided to students with low-income households through laptops, smartphones, mobile data packages and must fill the gaps by identifying and giving helping hand to them since 60% of the students are connecting through very poor equipment.

The future research will be recommended with a higher sample by adding more subjects since the larger samples may lead to stronger and more generalizable findings. It can be used a stratified sampling technique by covering island wide Regional and Study Centers depend on the number of student registration.

Students must be aware and motivated the importance of join all the sessions, regular practice with the computer baes software, high speed of typing, follow up the given lesson materials and videos, preparing short notes while following the lectures and prepare time and study plan to work effectively.

As the Students' skills and time are mediating factors between Students' Performance and Students' Online Satisfaction, they must be advised and aware to spend more time with their lessons and practice more and more with the practical examples and the key broad to success their final destinations.

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Business – Civil Society Collaborations in South Korea: A Multi-Stage Pattern Matching Study

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ABSTRACT

Our study seeks to achieve several objectives. First, we aim to identify the main dimensions that shape the outcomes of business-CSO collaborations from the literature. Second, due to the scarcity of research on this topic in South Korea, we examine to what extent the knowledge predominantly derived from other contexts are applicable in this research setting. Lastly, based on our findings, we theorize about the implications for MNEs seeking to enter South Korea. To do this, we followed a multi-stage pattern matching process comprising of qualitative flexible pattern matching and full pattern matching using SmartPLS.

Keywords - Cross-sector collaborations, Business-CSO collaboration, Corporate Social Responsibility, Collaborative behavior, flexible pattern matching, full pattern matching

1. INTRODUCTION

Multinational enterprises (MNEs) frequently interact with sociopolitical stakeholders such as civil society organizations (CSOs) across their home as well as host countries (Sun, Doh, Rajwani, & Siegel, 2021). These interactions are considered to be part of their non-market strategy and contribute to MNEs' competitiveness by reducing challenges associated with social, political, and institutional contexts (Mellahi, Frynas, Sun, & Siegel, 2016). There has been a growing number of studies in international business highlighting non-market strategies as an integral part of MNEs' overall international business strategy (Boddewyn & Doh, 2011; CuervoCazurra, Inkpen, Musacchio, & Ramaswamy, 2014; Doh, McGuire, & Ozaki, 2015; Doh, Rodrigues, Saka-Helmhout, & Makhija, 2017; Kobrin, 2015). Lucea and Doh (2012) propose that if MNEs are to design non-market strategies that appropriately fit their non-market context they need to pay attention to four socio-political dimensions; namely, stakeholders, issues, networks, and geography. Therefore, there is a need to match what we know about these dimensions in frequently explored research settings such as the United States and Europe to knowledge generated in less frequently explored settings such as South Korea and other Asian and African geographies (cf. Doh et al., 2015).

In this paper, we chose South Korea as our research context, because of the highly influential role CSOs play in the political and business environment. Understanding this context can help foreign MNEs entering South Korea reduce the institutional distance and design better non-market strategies. For instance, Kim, Amaeshi, Harris, and Suh (2013) highlight a quote by a South Korean CSR Manager *"we get too much political influence on CSR. I think this is typical in Korea… so businesses are not free to do what they think they should do anymore. Businesses have to pay attention to these pressures (from CSOs)"* (p. 2584). An important characteristic of South Korean CSOs is their active and direct

participation in politics both at an individual and group level and may even become politicians themselves. As a group, they have been involved in the birth and maintenance of past administrations. This is contradicting the concept of 'nonusurpation' suggested by Schmitter (1993) as associated with civil society. According to Schmitter (1993), CSOs "do not seek to replace either state agents or private (re)producers or to accept responsibility for governing the polity as a whole" (p. 4). This unique research setting highlights important implications for MNEs trying to expand into the South Korean market given the extent to which CSOs actively shape the socio-political environment. Further, understanding how South Korean firms engage with CSOs in their home country will also aid theorizing about their collaborative behavior with CSOs in host countries.

CSOs, also known as the 'third sector', 'independent sector' or 'non-profit sector' (Teegen, Doh, & Vachani, 2004), generally encompass "a very wide range of institutions and relations, from households, trade unions, voluntary associations, hospitals, churches, to the market, capitalist enterprises, indeed the whole capitalist economy" (Wood, 1990, p. 63). CSOs can be seen as 'non-traditional partners' and 'secondary stakeholders' wherein they do not hold formal contractual bonds with businesses (de Bakker & den Hond, 2008). The collaborations between business and CSOs have received considerable scholarly attentions (Arenas, Sanchez, & Murphy, 2013; Dahan, Doh, Oetzel, & Yaziji, 2010; Tencati & Zsolnai, 2012; Waddell, 2017). This strand of literature aims to enhance the understanding of what initiates those collaborations and how working with CSOs can benefit both domestic firms and MNEs. The United Nations (UN, 2015) declared cross-sector partnerships, such as business-CSO collaborations, to be an important element of the seventeen sustainable development goals with the potential to create value across sectors (Bäckstrand, 2006). However, successful collaborations are difficult to achieve, mostly because of the variations in collaboration motives or due to a lack of understanding where pockets of excellence are situated within relevant

networks (cf. Quélin, Kivleniece, & Lazzarini, 2017; Sinkovics, Sinkovics, & Archie-Acheampong, 2021b). The difficulty of managing business-CSO due to information asymmetry and potential differences in collaboration objectives led some scholars to liken such partnerships to 'odd couples' (Dahan et al., 2010; Rivera-Santos & Rufín, 2010) that are "not inherently successful" (Jamali & Keshishian, 2009, p. 282).

To this end, our study seeks to achieve several objectives. First, we aim to identify the main dimensions that shape the outcomes of CSO-business collaborations from the literature. Second, due to the scarcity of research on this topic in South Korea, we examine to what extent the knowledge predominantly derived from other contexts are applicable in this research setting.

Lastly, based on our findings, we theorize about the implications for MNEs seeking to enter South Korea. To do this, we followed a multi-stage pattern matching process.

The overall pattern matching process can be divided into various stages. These include partial, flexible, and full pattern matching. Partial pattern matching is completed either in the theoretical realm, where the researcher works with the literature to identify initial theoretical patterns; or in the observational realm, where the researcher starts with the data to identify theoretical patterns (Bouncken, Qiu, Sinkovics, & Kürsten, 2021; Shah & Corley, 2006; Sinkovics, 2018). Flexible pattern matching brings together a deductive and an inductive component. Initial theoretical patterns are deduced from the literature and are matched to observed patterns emerging from empirical data. More specifically, flexible pattern matching seeks to identify matches and mismatches between initial expected patterns based on the literature and observed patterns that emerge from the empirical data while simultaneously allowing new patterns to emerge from the data (Bouncken et al., 2021; Sinkovics, 2018). Lastly, full pattern matching aims to determine which alternative theory best explains an empirical observation. Structural equation modelling is arguably the highest level of full pattern matching to date as it involves pattern

matches at the structural level as well as measurement level (cf.

Hair, Hult, Ringle, & Sarstedt, 2017a; Sinkovics, 2018).

2. LITERATURE REVIEW

A previous grounded theory based study (Bouncken et al., 2021; Sinkovics, 2018). In this paper, we conducted a systematic literature analysis to construct our initial pattern matching framework that we, in a subsequent step, matched to interview data (see Table 2 and Table 3). The protocol for the search and article selection is detailed in Table 1. The literature review helped us identify three stages of business CSO collaborations as well as corresponding theoretical concepts that form the building blocks of our conceptual model (see **Figure 1**). Business-CSO collaborations generally follow three stages: (1) formation; (2) implementation; and (3) outcomes (Selsky & Parker, 2005).
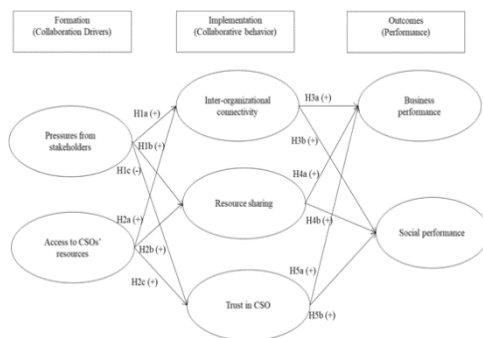

Figure 1- Conceptual Model

In this paper we define business-CSO collaboration as "a system of formalized cooperation between several institutions [involving at least one firm and one CSO], based on a legally contracted or informal agreement, links within cooperative activities and jointly adopted plans" (Wyrwa, 2018, p. 123). One feature that distinguishes business-CSO collaborations from traditional (equity) strategic alliances is that along with economic objectives, business-CSO collaborations also aim to fulfil

social objectives (Sakarya, Bodur, Yildirim-Öktem, & SeleklerGöksen, 2012).

The formation stage refers to the factors that drive organizations to collaborate with CSOs. Prior studies suggest two main drivers (e.g. Dahan et al., 2010; Weber, Weidner, Kroeger, & Wallace, 2017): the pressure from external stakeholders to collaborate with CSOs and the desire to gain access to the resources of CSOs. These drivers are linked to two main theories in the literature – stakeholder theory and the resource-based view.

Stakeholders are defined as "a series of groups able to criticize or apply pressure on corporate business activities" (Evan & Freeman, 1988, p. 97). Stakeholder theory links the survival of a firm and with its ability to address the needs of stakeholders (Kakabadse, Rozuel, & Lee-Davies, 2005). It suggests that firms are under constant pressure from internal and external stakeholders, and it is essential to construct amicable relationships with them. Drawing on stakeholder theory, studies have confirmed that pressure from external stakeholders such as CSOs, governments, and supply chain collaborators influence companies' decisions to create social value (Stekelorum, Laguir, & ElBaz, 2020; Wright, 2016) and collaborate with CSOs in social projects (Burchell & Cook, 2013; Egels-Zandén & Hyllman, 2006). For example, suppliers increasingly tend to follow a sustainable sourcing strategy, which requires them to provide materials approved by a CSO with respect to international ethical, social and environmental standards (Asgary & Li, 2016; Wright, 2016).

The resource-based view (Barney, 1991) suggests that firms possessing rare, valuable, inimitable and non-substitutable resources (VRIN) tend to attain a competitive advantage in the market. Firms always look to enhance their portfolios of VRIN resources either by developing them in-house or acquiring them from external sources via mergers, acquisitions or collaborations (Wernerfelt, 1984). Through inter-organizational collaborations, organizations expect to fill the internal

knowledge void by sourcing external knowledge. At times, firms may also have to look beyond traditional partners e.g., universities, research institutes and other companies to access knowledge resources they need for survival and growth. CSOs are such 'non-traditional partners' (Seitanidi & Crane, 2009). Unlike other organizations, CSOs are highly embedded in local communities and therefore, possess knowledge of the local market dynamics, distribution channels, institutional norms and culture (Hahn & Gold, 2014; Teegen et al., 2004). Such knowledge could be highly beneficial for firms to develop products specifically for these communities and ensure that the products reach the expected population (Dahan et al., 2010). Therefore, collaborations with CSOs can offer firms access to these unique resources, which might be difficult to access through traditional partners.

The implementation stage of business-CSO collaborations can be linked to the collaborative behavior displayed by partners to achieve their shared objectives (Heckman & Guskey, 1998). Our review of the literature uncovered three main concepts: inter-organizational connectivity, shared resources, and trust in the CSO's competence and good intentions (Jiang, Jiang, Cai, & Liu, 2015; Rivera-Santos & Rufín, 2010; Weber et al., 2017). Inter-organizational connectivity refers to "the communication and interaction mechanisms and relational structures that support the back-and-forth flow of knowledge and ideas" (Sinkovics, Choksy, Sinkovics, &

Mudambi, 2019) in collaborations. The resource sharing dimension includes the sharing of knowledge, capabilities, materials, human resources and social capital. Lastly, the trust dimension can be broken down into 'goodwill trust' i.e., trust that the partner wants to contribute to the collaboration and 'competence trust' i.e., trust that the partner has the capability to contribute to the collaboration (Jiang et al., 2015; Lui & Ngo, 2004).

Although the fundamental relationship between stakeholder pressure and collaboration with CSOs is as predicted from the literature (see Table 3), our flexible pattern matching exercise

revealed some differences in intensity that stems from the South Korean context. Specifically, whereas stakeholder pressure can be expected to lead to a certain degree of connectivity between the firm and the CSO in most institutional context, this relationship is likely to be much stronger in the South Korea due to government initiatives and the prominent and influential role of CSOs (Kim et al., 2013).

H1a: When the collaboration with a CSO is driven by stakeholder pressure, the firm is likely to invest in building inter-organizational connectivity with the CSO.

Our flexible pattern matching process corroborates evidence from other contexts that government driven collaboration business-CSO collaborations may lead to resource sharing. This is because both the firm and the CSO may be required to sign written commitments to resource sharing (Pratt Miles, 2013). As a consequence, the CSO may make a complaint if the firm does not share the resources to the extent stipulated in the agreement which in turn may lead to strict penalties (Tripsas, Schrader, & Sobrero, 1995). Hence, firms may be obliged to share resources with a CSO due to the government's intervention. If a business-CSO collaboration is formed due to consumer or client pressure, the parties may form joint teams, particularly to perform public communication activities. Such activities may include joint promotional events, marketing campaigns, publications and media briefings (Shumate & O'Connor, 2010). We found evidence in our qualitative data to support these expected patterns in the South Korean context. Further, we found that resource sharing is higher when the competence level of the CSO is high.

H1b: When the collaboration with a CSO is driven by stakeholder pressure, the firm is likely to share resources with the CSO

However, stakeholder pressure to collaborate with CSOs may lead to low levels of goodwill trust in the CSO (cf. Jiang et al., 2015). This is because the firm may be concerned about the motives of the CSO to press for the collaboration. Does the CSO intend to use the information received through the collaboration to expose the firm in the future? Is the CSO able and willing to

actively contribute to achieving the collaboration objectives (cf. Rivera-Santos & Rufín, 2010)? We found evidence for this in our qualitative data. Specifically, when there is government pressure to collaborate with a specific CSO, there is not always room for the firm to do their due diligence in terms of the CSO competence which may lead to problems during the collaboration and to reduced general competence trust in CSOs in future collaborations.

H1c: When the collaboration with a CSO is driven by stakeholder pressure, the firm is likely to have less initial trust in the CSO

2.1. The relationship between accessing CSO resources as a driver for collaboration and firms' collaborative behavior

Our flexible pattern matching exercise found support in the South Korean context for the general hypothesis derived from that literature that when a firm forms a collaboration with a CSO to access its resources, it is more likely to build inter-organizational connectivity. This is because building inter-organizational connectivity allows partner organizations to understand the depth and breadth of each other's resources (Ferreras-Méndez, Newell, Fernández-Mesa, & Alegre, 2015) as well as to identify who holds the required knowledge in each organization. In general, CSOs possess knowledge about the local customers' tastes, needs, and have network ties with local community leaders (Dahan et al., 2010). Further, CSOs are often hired by the government to design and deliver social projects on their behalf (Barr, Fafchamps, & Owens, 2005) and thus CSOs can possess high levels of social capital within government organizations (Den Hond, De Bakker, & Doh, 2015). This can be exploited by a firm for obtaining regulatory approval and a 'social license to operate' (Wilburn & Wilburn, 2011). As tacit knowledge is difficult to codify it is mostly transferred through personal relationships (Nonaka, 1994). Therefore, firms are required to implement communication strategies that facilitate face-to-face information exchange between the two groups of employees.

H2a: When the collaboration with a CSO is driven by the firms' desire to access CSO resources, the firm is likely to invest in building inter-organizational connectivity.

Our qualitative findings support the expected theoretical pattern that when a firm is driven to collaboration by the prospect of accessing CSO resources, it is more likely to implement strategies and routines that fosters resource exchange. For instance, joint integrated teams allow the partner organizations to get closer and access each other's tacit knowledge (Lam, 1997). Further, joint teams in public platforms and events signal a high degree of integration between the CSO and the firms, resulting in a better reputation. Our findings also indicate that co-location such as shared office space can further facilitate this process.

H2b: When the collaboration with a CSO is driven by the firms' desire to access CSO resources, the firm is likely to share their own resources in return.

When a firm initiates a collaboration with a CSO to access the CSO's resources, it is assumed that the firm is already aware of the potential of the CSO's resources and their synergy with the firm's resources. As opposed to situations where the collaboration is stakeholder driven, a firm is more likely to undertake due diligence when the collaboration is driven by a desire to access CSO resources. As a consequence, the firm will have a better understanding of the CSO's level of expertise and capacity to achieve the overall objectives of the proposed collaboration (Rondinelli & London, 2003; Seitanidi & Crane, 2009). Therefore, when a collaboration is formed with a CSO to access the CSO's resources without any pressure from external stakeholders, the firm is more likely to have high level of trust (Jiang et al., 2015) in the CSO.

H2c: When the collaboration with a CSO is driven by the firms' desire to access CSO resources, the firm is likely to have a high level of trust in the CSO.

2.2. The relationship between collaborative behavior and the outcomes of business-CSO collaborations

In business-CSO collaborations, inter-organizational connectivity is likely to play a bigger role than in usual equity alliances, especially because of the organizational differences terms of organizational culture, values, routines, performance measurement, leadership style, decision making processes and goals (Quélin et al., 2017). The findings from our interviews supports and extends the expected theoretical pattern that frequent and well-designed communication helps the collaborating partners to understand existing differences and fosters conflict resolution. This in turn reduces delays in the project and reduces costs (cf. Jiang et al., 2015). Therefore, inter-organizational connectivity is expected to lead to higher business as well as social performance outcomes.

H3a: A high level of inter-organizational connectivity leads to positive business outcomes in business-CSO collaborations.

H3b: A high level of inter-organizational connectivity leads to positive social outcomes in business-CSO collaborations.

In the context of equity alliances, scholars have empirically confirmed a positive association between resource sharing and collaboration outcomes (Weber et al., 2017). Similarly, resource sharing in business-CSO collaborations can also be expected to lead to enhanced collaboration outcomes. For example, accessing the knowledge of CSOs about the institutional environment and local market needs can enable firms to develop new products, target new customer segments and modify products (Dahan et al., 2010). Aligning products with local institutional norms may help the firm to gain legitimacy among consumers and regulators (Marano & Tashman, 2012). In addition, the sharing of human resources can allow firms to use the CSO's employees for marketing and product distribution purposes (Dahan et al., 2010). On the other hand, CSOs often lack financial resources needed for their social projects (Hale & Mauzerall, 2004). Therefore,

sharing financial and other resources with CSOs can be expected to lead to better social outcomes. Our interview data indicates that resource sharing may come in different shapes and sizes including applying for external financial support such as government funds.

H4a: A firm's resource sharing with their CSO partner will lead to positive business outcomes in the business-CSO collaboration.

H4b: A firm's resource sharing with their CSO partner will lead to positive social outcomes in the business-CSO collaboration.

Based on the findings from the literature review, it is expected that a high level of trust in the CSO will lead to cost reductions in terms of the legal, monitoring, and negotiation costs (Lui & Ngo, 2004; Zaheer, McEvily, & Perrone, 1998). In business-CSO collaborations, negotiations due to different priority objectives (Mars & Lounsbury, 2009) can lead to delays in coming to an agreement about the overall objectives of the collaboration and the terms and conditions. Further, a high level of trust between partners will allow them to discuss social and business issues freely, including those that are external to the project. Also, a high degree of trust will allow the firm to seek the CSO's advice in the product development process, although firms often try to keep R&D functions and product pipelines confidential (Dahan et al., 2010). Our interview data largely matches these theoretical patterns derived from the literature and suggests a positive relationship between trust in the CSO and the business outcomes of the collaboration. However, in our qualitative investigations we also explored the link between trust in the CSO and social outcomes. While we expected to find support for a positive relationship between these two theoretical concepts as well, the findings from the data suggest that trust in the CSO may be less relevant for the social outcomes of the collaboration than for the business outcomes.

Nevertheless, we hypothesize a positive relationship between trust and social outcomes in order to put it to further tests in the second part of the study.

H5a: A firm's high level of trust in their CSO partner will lead to positive business outcomes in the business-CSO collaboration.

H5b: A firm's high level of trust in the CSO will lead to positive social outcomes in the business-CSO collaboration.

2.3. CSO dominance and firms' level of standard adoption

In this section we will unpack the pattern that emerged from the interview data indicating that firms' trust in CSOs may not be as important for the social outcomes of business-CSO collaborations as initially expected. There are two additional patterns that emerged during the flexible pattern matching process that may be able to shed light on this unexpected pattern. These are the level of dominance of a CSO within the industry and the level of standard adoption by the firm. Examples for the latter are the United Nations Global Compact (UNGC), ISO 14000 environmental management standards, or attempts by firms to link their responsible business activities to the Sustainable Development Goals. Figure 2 provides an overview of the four scenarios including representative quotes from the data. The dominance of CSOs in an industry can be seen as a proxy for experience and competence.

In the high CSO dominance/low standard adoption scenario, the collaborating businesses tend to be small and medium sized enterprises. These businesses tend to have a lack of understanding of standards or simply not have the resources to adopt them. They attempt to compensate for these shortcomings by collaborating with dominant CSOs.

In the high CSO dominance/high standard adoption scenario, whether firms' trust in CSOs will lead to positive social outcomes of business-CSO collaborations will depend on more than just the availability of resources and the CSOs' competence. As the quote in Figure 2 indicates, achieving social outcomes may be hindered by public attitude towards the issue that the business-CSO project aims to tackle.

In the low CSO dominance/high standard adoption scenario, firms may have less initial trust in the CSO. This is because a lower CSO dominance within the industry may be equated with lower levels of competence. In this scenario, the collaboration is likely to have been driven by stakeholder pressure; or if driven by the firm's desire to access the CSOs' resources, this is more likely to be motivated by the necessity to legitimize their social or environmental project. Nevertheless, as the firm has a high level of standard adoption, it is more likely that there are positive social outcomes, as the firm will have the necessary expertise to make this happen.

Lastly, in the low CSO dominance/low standard adoption scenario, the collaboration is more likely to be for tax exemption or deduction purposes. If there is a positive social outcome, it is likely to be driven by the CSO or is simply a byproduct.

Figure 2: Conditions influencing the role of trust in business-CSO collaborations

In order to further explore these patterns that emerged from the flexible pattern matching process, we will conduct a multi-group analysis in the full pattern matching part of the study. Examining how the paths from the original model change under these four scenarios will allow us to theorize further about the role of trust in business-CSO collaborations.

2.4. Full pattern matching with PLS-SEM

The systematic literature review and the subsequent flexible pattern matching process supported the design of the structural and measurement models. We then collected survey data between November 2018 and February 2019 to complete the next stage of the pattern matching process. We drew on the databases of two intermediary organisations, the CSR Forum

(www.csrforum.org) and CSR Academy in Seoul, to identify potential respondents (in total, 530 companies). Although we initially sent the survey to CSR managers by email, we also provided the option to complete the survey over the phone or offline (cf. Dillman, Smyth, & Christian, 2014). The survey was originally designed in English and then translated into Korean which was validated by an accredited language expert.

We received a total of 224 responses (i.e. 42% response rate) out of which 215 were complete and valid. We used PLS-SEM for the next phase of the pattern matching process (cf. Liu, Sinkovics, & Sinkovics, 2020; Sinkovics, Liu, Sinkovics, & Mudambi, 2021a). Table 4 shows the general distribution of the firms included in the final sample. Most of the firms are Korean firms (92.1%) and more than 20 years' old (48.5%). As outlined in Table 5, 69.8% of the respondents are from Small Medium Enterprises (SMEs) and 30.2% are from large enterprises.

This distribution is justified considering that according to the National Statistical Office (2015), SMEs in Korea account for 99.9% of the total number of Korean firms. Most respondents (60.5%) consider their firms' collaborations with CSOs to be either extremely important (31.2%) or very important (29.3%).

3. MEASURES

All variables were measured using seven-point Likert scales, with 1 corresponding to strong disagreement and 7 to strong agreement. Stakeholder pressure was measured based on previous studies (Van Huijstee & Glasbergen, 2010). The items pressure from a range of stakeholders: (1) government, (2) supply chain, (3) CSOs, and (4) industry/trade associations. In most Asian countries including South Korea, due to a high power-distant culture, if a firm is "asked by/invited by/suggested" by an organization with a presence in the regulatory, social or business environment (most CSOs, supply chain collaborators and govt. organizations fall in this category), it usually implies "pressure". Access to CSO resources was measured by using items adapted from Dahan et al. (2010). The

measurement items reflected (1) CSOs' social capital such as networks and contacts, and (2) knowledge resources. The propensity of firms to build interorganizational connectivity was measured using items adapted from Jamali, Yianni, and

Abdallah (2011). Inter-organizational connectivity was categorized into (1) project-specific, and (2) relation-specific inter-organizational connectivity. The propensity of firms to share resources were measured using items adapted from Jiang et al. (2015) and include (1) human resources, (2) knowledge resources, and (3) social capital in collaborations. The extent of trust in CSOs was adapted from Lui and Ngo (2004). The measurement items capture both (1) goodwill trust and

(2) competence trust. Our dependent variables are the outcomes of business-CSO collaborations.

The measures of social performance are adapted from Hansen and Spitzeck (2011), whereas the measures of business performance are adapted from Steckel and Simons (1992). We also control for firm size and past alliance experience. Firm size is measured in terms of a firm's annual turnover and number of employees. Two dummy variables were created- "0" (or small-sized firms) if the number of employees is less than 500 and "1" (or large-sized firms) if the number of employees ≥500. Similarly, "0" were created if firms have no past alliance experiences with CSOs and "1" if they have past alliance experiences.

3.1. Common method bias

We assessed non-response bias and common method variance. We undertook the approaches outlined by Podsakoff and Organ (1986) to overcome common source bias. First, we assured all participants of anonymity. Second, we asked participants to report their 2017 sales revenue. Following the survey stage, we gathered secondary sales revenue data for 22 of the corporations in the sample. The correlation between primary and secondary data was 92.80%. Thirdly, we assessed common method variance by applying Harman's one-factor

analysis (Podsakoff & Organ, 1986). The results revealed that the first factor explained only 19.88% of the total variance and there was no single latent factor, which accounts for most of the variance.

However, Harman's single factor test has become rather criticized (Malhotra, Kim, & Patil, 2006). Therefore, according to the Rönkkö and Ylitalo (2011), we employed the marker variable technique. We chose the level of IT to use as a marker variable, as it is not theoretically correlated with any constructs in our research model. The mean correlation coefficients values for the marker item is 0.035, indicating insignificant influence of the common method bias. We further included this marker as a control variable (i.e. additional exogenous variable predicting each endogenous construct) into our PLS model (Rönkkö & Ylitalo, 2011). We compared the results of the marker model with the ones of our baseline model. As minimal changes to the estimates for the path coefficients occurred and all significant effects remained significant, we conclude that these results indicate that the common method bias is not a concern in this research.

3.2. **Measurement model assessment**

First, we assessed item reliability using Cronbach's alpha and composite reliability (CR) for each construct. CR can be considered as a more suitable measure of reliability for the PLSSEM method (Hair, Sarstedt, Ringle, & Gudergan, 2017b). All constructs had composite reliability and alpha values above 0.7, confirming a high level of internal consistency reliability. According to Hair, Black, Babin, and Anderson (2019), the minimum acceptable loading is widely 0.50. As presented in Table 6, factor loadings values of all measurement items show satisfactory scores of 0.50 and above. The absolute standardized outer loadings ranged from

0.574 to 0.893. Additionally, we tested convergence validity with the average variance extracted

(AVE) values. Table 6 shows that the AVE values are higher than the 0.50 threshold value

(Richter, Sinkovics, Ringle, & Schlägel, 2016). All of the below results provide the evidence of the reliability of the measurement in our measurement model.

Second, discriminant validity was addressed based on the cross-loading criterion suggested by Fornell and Larcker (1981).When comparing the square root of AVEs for all latent variables with the cross-loadings with other indicators (Chin, 1998), we established that each indicator loading was higher than the respective cross loadings, thus confirming discriminant validity of the constructs (Fornell & Larcker, 1981; Hair et al., 2019). In addition, to assess the constructs' validity further, confirmatory factor analysis (CFA) on each the individual constructs was conducted and we used a newer and stringent criterion for assessing discriminant validity, the heterotrait-monotrait ratio of correlations (Henseler, Ringle, & Sarstedt, 2015). With all values below the threshold value of 0.85 and the application of bootstrapped confidence intervals

(5000 bootstrap samples) to test whether the HTMT values were significantly different from 1.00 (Hair et al., 2017b), our results confirmed the constructs are empirically distinct and the constructed measures are reliable and valid (see Table 7).

Third, the standardized root mean square residual (SRMR) is the only estimated model-fit criterion in PLS path modelling (Henseler, Hubona, & Ray, 2016; Hu & Bentler, 1998). An

SRMR value of less than 0.08 is regarded as a good fit (Hu & Bentler, 1998). We found an SRMR value of 0.055, which indicated that we had a good model fit for the PLS-SEM analysis (Henseler et al., 2016).

Lastly, we evaluated endogeneity according to the systematic procedure proposed by Hult et al. (2018). By using the latent variables scores of the original PLS-SEM model to examine if one of the constructs has not normally distributed latent variable scores, which is a prerequisite to use Park and Gupta (2012) Gaussian copula approach (Papies, Ebbes, & Van Heerde, 2017;

Sarstedt et al., 2020). The Kolmogorov-Smirnoff test with the correction of Lilliefors via SPSS 22 shows the normal distribution (a significance of 0.200 for access to CSO's resource), which is one of independent variables in the PLS path model. Hence, this does not fulfill necessary criteria with Park and Gupta (2012) Gaussian copula approach. In such a case, we could assess endogeneity using the control variable approach in PLS-SEM (Hult et al., 2018). We applied two control variables such as firm size and past alliance experience in the model. According to Arndt and Sternberg (2000), firm size is an important factor influencing corporate behavior such as collaborations. As small firms tend to lack resources, they are likely to engage in collaborations.

The path coefficients between the control variables and the endogenous variable are explained in Table 8. The findings confirm that the control variables have not significant effect on the dependent variables. Therefore, we can conclude that this research has no endogeneity issues, and this finding confirms that the PLS-SEM model is robust.

4. CONFIRMATORY TETRAD ANALYSIS (CTA-PLS)

CTA-PLS is considered to be an appropriate approach to determine whether the latent construct is reflective or formative (Hair et al., 2017a). This statistical measure is based on an assessment of construct indicators. The latent construct is regarded to be reflective when all the tetrad values are non-significant (Hair et al., 2017a). Table 9 shows the CTA-PLS results indicating none of the tetrads displays a statistically significant difference from 0 that confirms the reflective nature of the constructs (Gudergan, Ringle, Wende, & Will, 2008).

4.1. Assessment of structural model

In accordance with Hair, Ringle, and Sarstedt (2013), the structural model can be evaluated with R^2, beta and corresponding t-values. They also encourage scholars to look at the effect sizes (f^2) and the predictive relevance (Q^2). First, we assessed the effect sizes, which signify the strength of relationship among the variables. The effect f^2 values of 0.02, 0.15 and 0.35 are used to explain that a predictor latent variable has a small, medium or large effect size at the structural level (Chin, 2010; Cohen, 2013). We found a small effect size of inter-organizational connectivity on business/social outcomes (f^2 =0.033, 0.143 respectively) and resource sharing also has a small effect on business/social outcomes (f^2 =0.060, 0.076 respectively). While trust has a medium effect on business outcomes (f^2 =0.786), the effect size of trust on social outcomes is found to be at the small level (f^2 =0.012). In addition, we performed a blindfolding procedure to evaluate the predictive relevance of the path model (Hair et al., 2017b). We evaluated the predictive relevance of the latent constructs by adopting the cross-validated redundancy Q^2 and the cross-validated communality Q^2 (Fornell & Cha, 1994). The Q^2 values of all latent constructs were greater than zero, indicating the predictive relevance of the model. As shown in Table 4, Q^2 values of all variables indicate acceptable predictive relevance. Also, the R^2 values of propensity of firms to build inter-organizational connectivity, to share resources and to build inter-organizational trust, business outcomes and social outcomes were respectively 0.314, 0.250, 0.074, 0.619, and 0.315 (see Table 11). Although R^2 values of 0.1 is considered as acceptable (Falk & Miller, 1992), it often varies depending on the research context. Considering the multitude of potential antecedents of trust, this construct's weak prediction is understandable (R^2 =0.074).

In order to test the hypotheses, we used squared multiple correlation and the path coefficient estimates. The path coefficient estimates on paths in the research model show the strengths of the relationships between two variables. The squared multiple correlation values indicate the amount of the variance for a dependent variable explained by an independent variable (Chin, 1998). Furthermore, we run bootstrapping with 5,000, which is the recommended number of bootstrap samples in order to test the path

significance level. Figure 3 and Table 11 summarizes the results of the hypothesis tests. It illustrates the assessed structural model conforming to the collaborations process: drivers, collaborative behavior and outcomes.

The path coefficient from stakeholder pressure to propensity of firms to build interorganizational connectivity is 0.337 (t = 5.305, p = 0.000). Thus, H1a is supported. H1b is also supported as the path coefficient from stakeholder pressure to propensity of firms to share resources is significant (t = 2.776, P = 0.006). The support for Hypotheses 1a and 1b implies when business-CSO collaboration is initiated by a firm due to pressure from stakeholders, firms tend to collaborate intensively with the CSO in order to absorb knowledge, expertise and social capital available for the CSO. The path coefficient from stakeholder pressure to trust (H1c) is not significant, which shows -0.032 (t = 0.419, p = 0.675). As we expected, resource-based antecedents (Hypotheses 2a, 2b and 2c) are supported. The path coefficient from CSOs' resources to propensity of firms to build inter-organizational connectivity (H2a) is 0.340 (t = 5.563, p = 0.000). CSOs' resources also have positive and significant effect on the propensity of firms to share resources (H2b) (t = 5.805, p =0.000) and on the firms' trust in CSOs (H2c) (t = 3.242, p = 0.001). Regarding the relationship between collaborative behavior and outcomes, H3a is supported because the path coefficient from the propensity of firms to build interorganizational connectivity to business outcomes is 0.111 (t = 2.026, p = 0.043). The path coefficient from propensity of firms to build inter-organizational connectivity to social outcomes is 0.325 (t = 4.880, p = 0.000), which supports H3b. Further, the propensity of firms to share resources with their CSO partners also has positive and significant effect on business outcomes (t = 0.194, p =0.005) and social outcomes (t = 3.942, p = 0.000). These positive relationships support H4a and H4b. Lastly, H5a is also supported as the path coefficient from trust to business outcomes is 0.631 (t = 13.197, p = 0.000). However, H5b is not supported as the results of the path estimates from trust to social outcomes is not significant (t = 0.683, p = 0.494).

4.2. Multi-group analysis

Prior to multi group analysis, the calculation of the invariance of its measurements was conducted by using MICOM (measurement invariance of composite models) procedure involving three steps approach; (1) configural invariance, (2) compositional invariance, and (3) the equality of composite mean values and variances (Henseler et al., 2016). Table 12 illustrates the outcomes of the measurement invariance testing from each step. After completing the MICOM procedure, multi-group analysis (MGA) is conducted by inspecting different combinations of level of adoption of national/international/environmental labor and quality standards by the firm (low/high) and the level of dominance of CSO (low/high), which resulted in subgroups of 36, 38, 43 and 35 observations and all of the subgroups in this study fulfilled the acceptable sample size of 34 (Hair, Sarstedt, Ringle, & Gudergan, 2018).

In the survey, based on 7 points Likert scale respondents were asked to report to what extent their organizations adopt national/international labor, environmental and quality standards (1=to a very small extent, 7=to a very large extent) and how dominant the CSO is in the sector (1=not at all dominant, 7=extremely dominant). As illustrated in Figure 2 there are four scenarios representing combinations of conditions that may potentially shape the role of trust in businessCSO collaborations. The aim for MGA is to examine path changes in the base model across different collaborative scenarios, enabling us to theorize about collaborative behavior in different business-CSO collaborative context. We divided the sample along two dimensions: 1) the level of adoption of national/international/environmental labor and quality standards of firm and 2) the level of dominance of CSO. Figure 4 provides a graphical overview of the findings, while Table 14 provides information about the effect sizes and R^2 values for the full model as well as the four models for each scenario.

The findings tell an interesting story demonstrating the power of SmartPLS for theorizing and pattern matching at the highest level (cf. Liu et al., 2020; Sinkovics, 2018;

Sinkovics et al., 2021a). We will discuss the findings and their implications in the next section.

5. DISCUSSIONS AND CONCLUSION

In this study, we employed a multi-stage pattern matching process to identify the main dimensions that shape the outcomes of CSO-business collaborations from the literature and examine to what extent and in which way they apply in our specific study context, South Korea. This process allowed us to theorize in stages. The findings from the qualitative flexible pattern matching part of the study revealed that although the general theoretical concepts and the relationships between these concepts may hold in the South Korean context, they may mask a more complex and nuanced story. Additionally, two dimensions emerged from the qualitative interviews that prompted us to explore them further with a multi-group analysis in SmartPLS. These were the level of dominance of CSOs in an industry and the level of standard adoption of the collaborating firms. More specifically, the qualitative data suggested that under these different scenarios, stakeholder pressure and the role of trust in CSOs' goodwill and competence may have different implications for collaboration outcomes.

The effect sizes in Table 14 suggest that, in general, stakeholder pressure to collaborate is less effective in driving firms' collaborative behavior in a business-CSO partnership than firms' motivation to access CSO resources. This finding is somewhat more refined when looking at the effect sizes in each scenario; however, it generally holds. Further, when there is stakeholder pressure to collaborate, trust in CSOs seems to play an insignificant role. At the same time, trust in CSOs is more important to achieve positive business outcomes than resource sharing and inter-organizational connectivity.

On the other hand, in terms of achieving social outcomes, trust in CSOs does not seem to have a significant impact on the outcome; however,

inter-organizational connectivity and resource sharing does. This latter finding is consistent across all four scenarios even when CSOs are not dominant in the industry. Initially, we expected that stakeholder pressure to collaborate with CSOs will lead to reduced trust. However, the non-significant result of this path may simply reflect the integral part CSOs are playing in the South Korean context. This is because collaborating with CSOs seems to be more important for a social license to operate than in the US and European context. As a consequence, MNEs wishing to enter South Korea are advised to seek collaboration with CSOs to enhance their legitimacy. The differences across the four scenarios imply that the effects of the collaborative dimensions are strongest when the firm has a high initial level of competence proxied by standard adoption. As a result, not being able to secure collaboration with highly dominant CSOs may be less problematic for foreign firms if they have a high level of general competence through the adoption of standards.

On the other hand, when collaborations are driven by firms' desire to access CSO resources, trust in CSOs seems to play a significant, even if comparatively small, role when the

CSO has a high dominance within the industry. This can be explained with managers' tendency to proxy dominance with a high level of competence. Additionally, when the initiation of the partnership is driven by the firm and not by stakeholder pressure, firms are more likely to be able to engage in due diligence. This may not be possible when the request to collaborate with a specific CSO comes directly from government bodies.

Future research will need to uncover additional factors that contribute to enhancing the social outcomes of business-CSO collaborations. Although inter-organizational connectivity and resource sharing seem to have a significant impact on social outcomes, the R^2 values indicate that there are additional important dimensions that were not part of this study.

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Government Portal: An eGovernment System for Government Advancement a Leading and Effective Approach

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ABSTRACT

Application of eGovernment Systems for public value improvement with the right toolset strengthens the establishment of a reliable and well-suited platform for both administrators and public around the globe. The purpose of this research was to identify requirements for developing an eGovernment system for public welfare, the research was carried out in the Democratic Socialist Republic of Sri Lanka which included participants of Sri Lanka and of International Territories where their preferences and requirements in an eGovernment system were questioned using a survey and the study of results showed high curiosity and demand from the public. To test the approach a single department of the government was digitalized while adhering to the full-scale architecture which will allows resources of all other departments to be digitalized and merged to a single prominent system when required. The software application suite developed for citizens and administrators worked as expected by both providing simplicity and effectiveness with government transactions. The project builds the initial foundation for the development of an effective full-scale horizontal integration level eGovernment system following stage plans and e-government dimensions.

Keywords: e-Administration, e-Citizens, e-Governance, e-Government, e-Services, e-Society, Social science, Vertical integration.

1. INTRODUCTION

The necessity for maintaining performance at work has become a fundamental requirement for many businesses, change management and sustainability in the competitive market has its own stumbling blocks in a changing environment. It is an eminent fact that citizens are the most precious assets of a government which makes their well-being an important body of interest, so this study explores a strategically innovate approach to fulfil this requirement by use of technology.

Government Portal is a software for digitalizing government systems and will be a replacement for the paper-based systems currently in use by the majority of the governments in the world, with the use of digitalization all government application processing services such renewals of passports, driving licenses and other services such as payments of income tax would be done electronically at a single place. (See software: https://lranul.github.io/RPLS/)

For the purposes of user identification, the system would supply an electronic card, that allows citizens of any status to be benefited to use the system, this is achieved by allowing them to use the system without extra knowledge or training only by handing over their card as identification at government

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centers and non-government centers. Once presented necessary data can be retrieved from the system for further processing.

Government would be benefitted by gaining prominent level access to monitoring, managing of services and data, this will support in mitigating unauthorized activity in a country.

The system will store all information including activities of a user such as health, educational, police records, etcetera but only relevant parties will gain access to user data.

This level of access was provided for managing records and the design creates a virtual barrier that is seen in the physical world, providing a similar level of protection of data by encapsulation.

2. Bᴀᴄᴋɢʀᴏᴜɴᴅ

2.1. What is an e-government?

E-government could be stated as the government's use of technology to delivery government information and services to citizens, businesses, and other partner entities, thus enhancing the communication process with the use of technology (Layne & Lee, 2001)

2.1.1. Nature of public encounter and digital encounter

The second aspect concerned on this research was on how the stakeholders would be affected by the digitalization of government services.

For a citizen to work with the government they should first communicate, this initial encounter judges the first impression a customer perceives of the services provided by the government. Primary research done by Public Governance Institute shows that these main factors that a citizen expects for could be broken down to three distinct categories: (1) exchange of information, (2) provision of public services and (3) control or constraint (Van de Walle, 2017). Further, numerous

strategies have been recommended by researchers over the past decades to fulfil common gaps seen.

During a digital encounter for instance use of digital forms instead of mailing papers, support agents to facilitate questions raised by visitors and forms of technology for automation would make systems more efficient and effective (Lindgren et al., 2019)

2.1.2. The effective approach

Governments around the world are affected by the ongoing economic crisis, but significant effort is taken to prevent any form of economic collapse.

Due to this governments take extra precaution in investments as a major part of the government reserve goes for novel virus aids, reliefs, and economic security projects.

Citizens play a vital role in sustaining a government so fulfilling their requirements means a profitable future to the nation, governments in the northern Europe such as the Government of the United Kingdom has brought rise to Digital Economics "to make the delivery digital service of the government more efficient and effective" (Government Digital Service, 2020). As in the research done by K. Layne and J.

Lee shows digital transactions offer improved efficiency for both the customer and the agency than simply cataloguing information. Officers and citizens has already identified potency of the internet to get services done online rather than visiting a common place to complete paperwork (Layne & Lee, 2001). By the use of viable technologies and existing resources to implement an e-government system would be best and most effective approach at the time being for further information about implementing a e-government system have been elaborated on section 2.1.3 on strategies for transition from catalogue to transaction stages and section 2.4

on the suitability and opportunities for developing countries.

2.1.3. The four-stage model for e-governments

Government is the supreme authority in most countries having the authorization to govern and control all entities in its territories, so developing a system to manage the great authority of power is not a process that could be accomplished with ease, but with proper strategy and following of a best suited methodology (Layne & Lee, 2001) that would allow a perfect implementation of the e-government system to developing countries as it have been already incorporated in most of the developed countries and already standing in as a driving force of success to the lives of citizens and businesses (Ndou, 2004).

Presently majority departments and ministries of the Government of Sri Lanka where this study was conducted has a public website that is hosted and managed by every government department, the websites provide information on gazettes and access to downloadable application forms.

The current system is at the 'Catalogue stage' in contrast to the stage model. Implementation of the e-government web application would allow all these government services to be transitioned to the Integration stage.

Introducing service-oriented architectures to the study will provide governments to use services they prefer on their

Government Portal system and citizens will be able to use the usual services without difficulties such as making payments and communicating with the administration through the web application and other introduced public interfaces such as kiosks.

By networking all departments/ministries at one stop shop portal will bring the system to

most prominent Horizontal integration level allowing them to leverage on full capacity.

Figure 1. Illustration of Dimensions government development
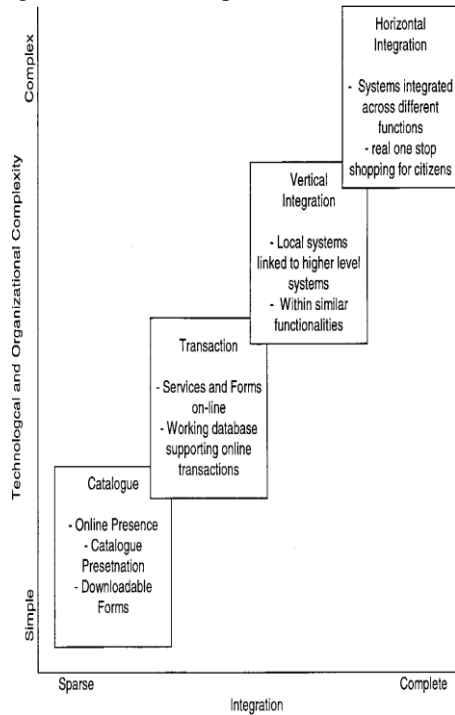
2.2. Public value in e-government systems

Primarily, the wellbeing of people and the search for improvement of life has been a crucial requirement of all humans. We have improved over the spans of arduous work by building communities, kingdoms, empires, and governments all having the goal of improving public value. In this pursuit for public value, governments deal with fulfilling the objectives of social wellbeing for citizens which are considered critical to develop a system (Cook and Harrison, 2014).

2.3. Applications of e-government systems

So, in the implementation of e-government systems it becomes a crucial goal for the architects and engineers to design and build a system that provides citizens with openness, democracy, participation, transparency, and

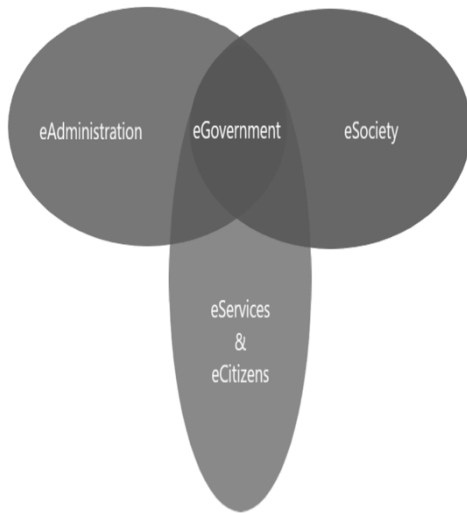capability to meet requirements of citizens today and tomorrow.

Figure 2. Illustration depicted of the dimensions and stages of e-government development (Layne & Lee, 2001)

The (OECD, 2019) publication begins with the term people-centric which implies the importance of citizens to a government's sustainability and use of data from people to design and implement the government policies and it also states that "Trust in government remains a key measure of government performance" and that some countries have already "established online service platforms" and have "priorities digitalization to enable greater efficiency and effectiveness of public services", thus achieving citizen expectations.

Further, to fully exploit the application of the e-government system, the existing differences in interrelationships between services and e-services should be mitigated by applying proper strategies and to focus on the development of (1) e-Citizens, (2) e-Services,

(3) e-Administration, and (4) e-Society (Twizeyimana & Andersson, 2019).

2.4. **Citizen satisfaction with e-governments**

The great administrative reform in the 1980s, introduced the concept of citizens as client and client-oriented architectures which directed traditional bureaucratic ways to more a service and customer experience process.

These brought rise to citizen surveys and analysis of their requirements helped to build better business by satisfying customer needs, where the parturition of e-governance started by allowing a meandered and gradual shift from industrial centric ways to more successful customer and demand centric ways.

This brought rise to standardization of public services which was once considered detrimental to fulfil customer satisfaction being a single party.

However, standards were brought back to maintain quality of service which in turn effects the satisfaction of citizens.

Considering all these factors new methods of collaboration within the communities using digital means allows governments to maximum benefits from e-governance and continue to act as the regulator of national wide services while maintaining customer satisfactions (Van de Walle, 2017).

3. **SOFTWARE DESCRIPTION**

The following section will first describe the modular and flexible design of the software and afterwards, on the core functionalities of the software.

System architecture

The structural design of Government Portal is modular, so each component has its own purpose allowing expansions much easier compared to a fixed design.
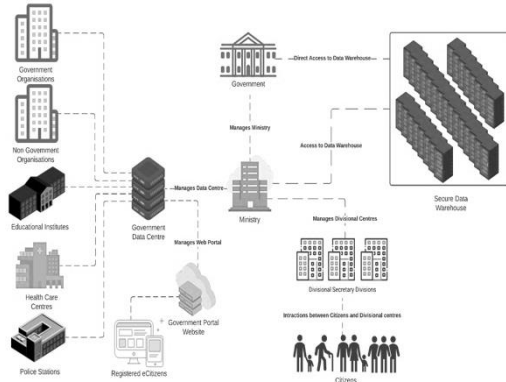

Figure 3. Schematic of the software architecture. The software is designed to host services of each department or ministry of a government.

The core functionalities of a fully integrated e-government should consist of online forms and all-in-one service with support services which would mimic the physical work environment.

Citizens will be able to use the internet to access the portal over the web and consume all digitalized services, additional other secure transactions handled by the departments will be transferred over an intranet within the country only. This design would allow citizens to consume government services of the country of their citizenship from anywhere in the world. A schematic of the system network is illustrated in Figure 4.

Governments will not have the flexibility to change the framework being the template of reformation but by using the same source code allows to work on builds and patches can be released quickly. The identification data of a person is key tagged to a generated highly secure passphrase cypher key uses American Encryption Standard (AES) rather than their personal or biometric data, making

transactions and access much safer in foreign territories.

These additional engineering in Government Portal software suite makes it secure in design and allows very cost-effective scalability and reliability with cloud-based hosting services.

3.1. **System functionalities**

A simplified graphical user interface (GUI) is designed by following facade design principles to conceal the complex design.

The Government Portal GUI manages all inputs from the administration and citizens and works by validations and manipulates data before sending to backend servers to prevent script-based attacks. Color schemes, icons and layouts were selected by identifying accessibility features, so the software is usable by people with disabilities.

The administrative software allows full control of all the services in the government, allowing shutting down and halting services, telemetry data is collected from all connected devices and logged for service usage.

Accounts and digitals cards of the systems users can be managed by the same interface.

The officer software which will differ for each department with services they offer will contain some mandatory facilities such as a communication service to interactive with citizens to resolve issues and verifications tools are inbuilt as part of security requirements to identify misconfigured of fraudulent accounts and digital cards.

To further outreach citizens, a software for kiosk machines was engineered allowing the same services to consumed as of the web application, this will allow the government use local languages on the software and will become the first interface a citizen would use their digital card before government and non-

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government organizations start consuming e-government services over its

Application Programming Interface (API) for services. For example, a job applicant might only need to scan or enter their digital card and all relevant information such as biological, educational, work, and legal would be prefilled and presented to the company via the e-government system for next steps of recruitment process can take place.

For all communications on the databases, storage, and configurations a directory service that is based on privileges per user category was predefined by setting up rules to be prechecked before allowing access to data and modifications, this further reduces unauthorized use or modifications to data on the public interface which can accessed over the internet and will be most vulnerable to attacks. Using cloud-based backend service, required access rules and common attacks such as Distributed Denial of Service (DDoS) attacks are mitigated.

4. IMPACT

Administrative reformation in many nations brought forth the need for technology and to reduce costs and to market services beyond the country borders.

Majority of the European Union is starting to shift to e-government systems, already countries have services of the government being digitalized which have significantly reduced administrative costs and have brought forth new forms international business by allowing e-citizenship schemes.

This study was concluded after identifying the underlying requirements of initiating an e-government system and therefore engineered this software to be a prebuilt template which can be used by governments in the world to build their own government digital service for

a very low setup cost, having all the core functionalities.
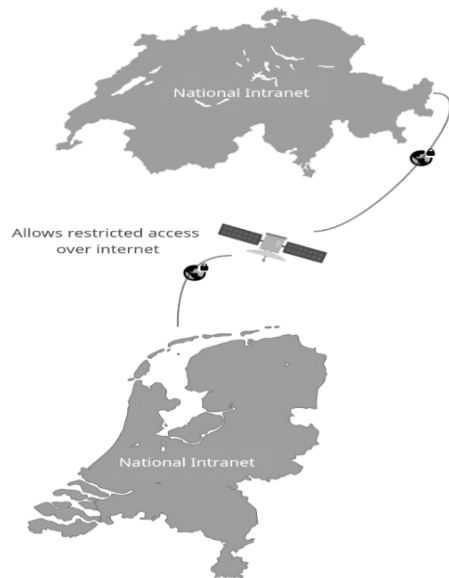
Figure 4. Schematic of the system network

Using a networked system helps to create new connections that was not possible before, outbound transactions are possible for detail verifications and more reliable security updates. For example, a foreign embassy of a country conducts a validation on provided information of a visa applicant overseas by communicating with the system of the applicant's country over the API for foreign affairs. Having a modular design and security mechanism, data will be encapsulated allowing only limited and relevant data to be accessed.

The system was tested for functionality by studying a selected ministry of the Government of Sri Lanka. As the collection of citizens data is crucial so department or ministry managing citizen data was studied. Services provided by national person registry were implemented with other core functionalities identified to be required. National Identification Card application processing services were digitalized and tested, as expected the system allowed to track

applications, resolve issues by contacting support services.

Finally, the system was also tested on security-related issues. Penetrations to database was attempted but preconfigured firewall rules denied access and business logics set to lock digital cards and accounts were working as expected. This concluded that the system achieved its planned goals and will allow to expand further with its modular design, by providing flexibility to enforce data protection and policies as required by a government.

5. CONCLUSION

The developed application provides a government's services in a digitalized format and the government is provided as a service to citizens, this adaptable software system could be used by any government to improve overall productivity of a digitalized government.

To be solely benefited from this software system in production environments, it's high-level architecture should be followed with flexible changes to services used, which would allow governments to customize the system to their internal policies and laws.

- Store complete biological data of citizens in the government database to identify them via several ways.
- Move to a large scale and more compliance No SQL database such as Azure Cosmos.
- Replacement of Portal ID in future to automated scans via biometric scanners for services.
- Scale customer and investor reach with cross-platform production builds, current framework and languages used allows this although one platform build have been produced to manage planned project budget.
- Protect highly sensitive data using a permission based, high secure government data center
- Data privacy, for storing highly sensitive information it is recommended to use a local data center powered by Firebase

backend service framework this would allow same cloud functionality to be archived in a local area network connected via the internet making the service locked in local ISPs access for data protection and management of regional laws on privacy and policy.

Imposing these services recommended would allow governments that renovate with digital services to be entirely benefitted from Government Portal's engineered design.

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Successful Implementation of Enterprise Resource Planning System (ERP) in Sri Lankan Small and Medium Scale Manufacturing industries: Client & Consultant Perspective.

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ABSTRACT

Today's business environment is highly competitive with the booming trend of technological innovations. Every business gives priority to maximizing profits. Cost reduction is one of the key factors in maximizing profit. Therefore, current business organizations use technology as one of the techniques to achieve effectiveness. When the technological environment in current businesses is considered, systems are the most important factors that are used to improve productivity and efficiency. Integrated systems are at the highest level when considering systems. Out of all the integrated systems, Enterprise Resource Planning systems (ERP) can be given priority. Sri Lanka, like other countries, invests vastly in ERP implementation to achieve the ERP implementation goals and objectives. However, not all ERP implementations deliver the promised enterprise improvements. There are situations where ERP implementation has become a failure as well. Many critical factors have affected these failures. Previous literature says many factors effect ERP implementation success or failure. Therefore, this study relating to Sri Lankan small and medium enterprises (SMEs) further explores those factors' influence on ERP implementation. Thus, this research followed a qualitative approach using the strategy of case study, followed by nine in depth interviews from the perspective of client and consultant, conducted in the specific industry personnel who implemented ERP successfully in their organization.

Keywords: Critical Success Factors, Enterprise Resource Planning System, Manufacturing Sector, Small and Medium Enterprises, Sri Lanka

1. INTRODUCTION

Globalization is one of the most important factors that has both positive and negative effects on business performance. One of the main purposes of all businesses is to make a profit from their operations. Implementation of systems using current technology contributes highly to profit maximization in businesses. The business environment relating to the implementation of systems can be divided into two parts: internal and external, where to address the competition and necessary improvements in technology, laws, government activities, and market social and economic trends. Therefore, this research focused on the identification of the importance of systems using technology in the business environment. Integrated systems are at the highest level when we consider a system such as enterprise resource planning systems (ERP), which are being used popularly in many businesses. Shah (2016), implemented an ERP system within an organization and changed the way people work and achieved the benefits of process automation, proofing mistakes, and high productivity.

An enterprise resource planning (ERP) system is an integrated software solution, typically offered by a vendor as a package, that supports the seamless integration of all the information flowing through a company, such as financial, accounting, human resources, supply chain, and customer information (Davenport, 1998). According to Oracle (2019), "Enterprise resource planning" refers to a type of software that organizations use to manage day-to-day business activities such as accounting, procurement, project management, risk management, compliance, and supply chain operations. A complete ERP suite also includes enterprise performance management, software that helps plan, budget, predict, and report on an organization's financial results. Work WiseSoftware (2014) highlighted a vast number of top benefits of implementing ERP software in business. However, there are pros and cons to all the implementations that were explored by the study as findings which will benefit the small and medium-scale manufacturing industries in Sri Lanka.

The Government of Sri Lanka recognizes SMEs as the backbone of the economy, as they account for more than 75% of the total number of enterprises, provide 45% of the employment, and contribute to 52% of the Gross Domestic Production (GDP). Levinson (2018). Manufacturing is the process of transforming materials or components into finished products that can be sold in the marketplace. Hence, the research study diverges the findings to explore a holistic view of the implementation of ERP for SME manufacturing. Following are the questions set in order to address the objectives of the study from the perspective of the client and consultations.

1. What are the organizational factors effecting ERP implementation in Sri Lankan small and medium-scale manufacturing industry?
2. What are the technological factors' effects on ERP implementation in Sri Lankan

small and medium manufacturing industry?
3. What are the human factors that affect ERP implementation in Sri Lankan small and medium-scale manufacturing industry?

2. LITERATURE REVIEW

The term ERP roots the date back to the 1960s that applied to inventory management and control in the manufacturing sector (Netsuite 2019). Software engineers created programs to monitor inventory, reconcile balances, and report on status. By the 1970s, this had evolved into Material Requirement Planning (MRP) systems for scheduling production processes. In the 1980s, MRP grew to encompass more manufacturing processes, prompting many to call it MRP-II or Manufacturing Resources Planning. By 1990, these systems had expanded beyond inventory control and other operational processes to other back-office functions like accounting and human resources. Today, ERP has expanded to encompass business intelligence (BI) while also handling "front office" functions such as sales force automation (SFA), marketing automation and ecommerce. With these product advancements and the success stories coming out of these systems, companies in a broad range of industries from wholesale distribution to ecommerce to use ERP solutions. The history of ERP goes back more than 100 years (Oracle 2019). In 1913, engineer Ford Whitman Harris developed what became known as the economic order quantity (EOQ) model, a paper-based manufacturing system for production scheduling. Enterprise resource planning (ERP) software systems were first made available to very large organizations, having grown out of the manufacturing resource planning (MRP) systems that had been in use since the 1960s (Radley 2018).

A successfully integrated ERP system can enhance operational efficiency by supporting a firm's business processes as well as create competitive advantages by enabling innovative

practices (Al-Mashari et el., 2003). ERP system acquisition and implementation generally enhance productivity and working quality, since the system offers standardization and simplification in multiple, complicated operational procedures across the company Nah *et al.*, (2001).

The information systems consist of two categories, personal information systems which can manage and store information for a private person and second information system is an enterprise information system that tailored toward the support of an organization (Silva, 2017). Mario & Robert (2009), to integrate CSF management into project execution, researcher propose the ACSF method. From these factors which were discussed by Mario & Robert (2009), same as Claude, Koen, Stephan & Eric (2010), discussed Top management support, Business plan, Effective communication, Project management under five themes. According to Claude, Koen, Stephan & Eric (2010), the merging of the lists of CSFs for ERP implementations found in the literature leads to a list of over 40 candidate CSFs. In order to structure these candidate CSFs, researchers divide them into five groups as vision, scope, goal, culture, infrastructure, approach, project management. Claude, Koen, Stephan & Eric (2010), suggested that the largest fraction of the critical success factors found in the literature applies to the four-implementation studied. This indicates that a majority of critical success factors that are valid for large companies are also applicable to SMEs.

As such, employees are accustomed to change, making change management a far less important issue. According to (Shashank *et al.*, 2013), CSF are those factors or conditions which are the most important for successful implementation of ERP. These categorizations include above Claude, Koen, Stephan & Eric (2010), discussed factors like top management support, Vision, Project management also some other factors under three categorizations of organizational factors, technological factors and people factors. Mario & Robert (2009), found some factors like Top management support, Knowledge

management, Effective communication also discussed by (Dimitrios *et al.*, 2011). When above researchers used framework like, people, organizational, project management factors as CSF Uchitha & Saman (2013), nine factors, identified through the literature, were selected that are most relevant to the Sri Lankan context through a pilot study carried out among domain experts in Sri Lanka. Those nine factors have been categorized under three main stages of the ERP implementation i.e. pre-implementation, implementation and post-implementation. Therefore, this is a positive sign as far as Sri Lankan ERP implementations are concerned. (Hooshang *et al.*, 2014), used following critical succes factors for the reserch study almost same with what Mario & Robert (2009). When, (Hooshang, Bruce, Dale, & James, 2014) identified above factors almost same factors which were identified by (Poonam & Divya, 2014) used following CSFs Shashank *et al.,* 2013 idetified organizational, Technological, people factos as the CSF in their study. But, (Poonam & Ajay, 2015) slected project management factors also to their study & used follwing CSF in their study.

First, this study has contributed to academic research by producing the empirical evidence to support the theories of affecting factor and ERP implementation success. The research has empirically verified that organizational, technological, people and project management factors are positively affecting the success of ERP implementation. Second, the results are largely consistent with prior studies conducted in other developed countries. As (Hooshang *et al.,* 2014) discussed including top management suuport and other CSF also discusssed by Raafat & Harshjot (2016). Shivam *et al.,* (2018) successful implementation of cloud ERP. Thus, researchers infer that the critical success factors of SMEs and the concerns faced by clod vendor needs to be in-sync so that the implementation of cloud based ERP can be termed as successful.

Based on the previous research studies discussed above, lots of researchers used organizational factors, technological factors, people factors and project management factors

as their CSF. Therefore, researcher may use following research framework for this study which are relating to Sri Lankan SMEs in Manufacturing sector and further explore what are the factors which are in additions affecting to ERP implementation success; Organizational factors, Technological factors, People factors and Project management factors

3. METHODOLOGY

Qualitative research methods originated from various sciences like sociology, anthropology, and psychology and are able to deliver excellent results, according to Carol (2016). The responses were received from nine in-depth interviews conducted based on a scheduled plan with both clients and consultant over the phone. A thematic analysis was conducted in the data analysis. The popular CAQDAS NVivo software is used in the data organization and cross-analysis in the data analysis. What factors influence successful ERP implementation?This study is based on five consecutive cases, which are related to the manufacturing sector and industries like cosmetics, pharmaceuticals, agricultural, coconut, and tea. Selected five SME manufacturers, such as Phama, Coco, Tea Teste, Cosmatic, Agric-Chemi, etc..

Case study analysis – RQ 1
The normative and mimetic pressures, which are explained in the institutional theory and imply in the selection of ERP systems, are an important sub theme discovered by the analysis.

When clients are required to evaluate and select the right ERP systems for their organizations, choosing the software is just one piece of the puzzle. The next steps are to develop a comprehensive and realistic implementation plan and to identify the best ERP implementation partner to help make the selected software work for the business. As a result of that, most companies purchase the wrong things when choosing an implementation. For example, the number one

priority that many companies focus on is the implementation partner's technical and functional experience with the ERP software. Evaluation factors such as software certifications, technical competencies, and number of implementations with the chosen software often rate high on the lists of executives. However, this is one of the least relevant aspects of choosing an implementation partner.

Phama manufacturer's product finance as stated by the client;

"There were some positive recommendations from one sister company about the ERP vendor, because, they already implemented ERP from this vendor successfully."
As per all above discussions had with managers and project managers most of the companies selected their implementation partner based on the previous ERP implementations company recommendations which is termed as references.

Technical evaluation: According to (Panorama Consulting Group, 2011), How company decide which ERP system to implement when internal bias and vendor enthusiasm threaten to sway the user? The best way to evaluate ERP systems is to weigh the strengths and weaknesses of each according to the six criteria; Deployment options, Scalability, Technical fit, references, return on investment and product viability.

This theme supported from the following quotations.

Product finance of Phama manufacturer stated from the client side
"We evaluated quotations based on the presales demonstration done by ERP vendor presentation. We checked whether our requirements are available or not. And checked the price also with the initial discussion."
When analyzing all these interviews researcher found that whole companies gave their priority to select the ERP product with considering whether the company requirement can be

fulfilling by the ERP system. And, they have done some cost comparison between larger ERP like SAP R3 version, oracle, and SAP Business one, Oracle NetSuite etc. The theme emerged out from this narration was named as technical evaluation.

Solution mapping: According to (Helpjuice, 2018) Knowledge management is the systematic management of an organization's knowledge assets for the purpose of creating value and meeting tactical & strategic requirements; it consists of the initiatives, processes, strategies, and systems that sustain and enhance the storage, assessment, sharing, refinement, and creation of knowledge. This theme can be supported from the following quotations. According to the Senior Application Consultant on the consultant side,

" Before doing the implementation we are doing requirement gathering and based on the requirement gathering we are doing solution mapping. Before that, we are identifying business process of the customer then doing the implementation. Then we do the requirement gathering and solution mapping of the client business process. So that, basically, as a consultant we have the general idea about the client business process and the business environment before going to the implementation. "

Basically, all above implementations were done by implementation consultants based on their standard ERP process knowledge. After they have done the system studies identified and mapped to the system specific requirement according to the industry requirements. Hence solution mapping become one of the important factors in the implementation of ERP system.

Communication plan: Communication plan is a policy-driven approach to providing stakeholders with information. The plan formally defines who should be given specific information, when that information should be delivered and what communication channels will be used to deliver the information. An effective communications management plan anticipates what information will need to be communicated to specific audience segments. The plan should also address who has the authority to communicate confidential or sensitive information and how information should be disseminated (email, websites, printed reports, and/or presentations). Finally, the plan should define what communication channels stakeholders will use to solicit feedback and how communication will be documented and archived. Business Solutions Specialist stated that from consultant side;

"There is an available resource for supporting purpose from their side. There was supporting person from their side, when, we are handover the initial project. Then, we have supported them over the phone and through email. Anyway, if there is any issue, our resources were available to the client support. "

According to all above five projects communication plan includes on-site support, support through over the phone and the emails and major communication through project manager who is involving both customer side as well as implementation vendor side.

RQ2: Under this technological factor, we discussed the technological factors which affect ERP implementation in Sri Lankan SMEs in the manufacturing sector and the following themes were elicited under the technological factors during the research study.

IT infrastructure: An ERP implementation is only as good as the infrastructure that lies beneath. If a company doesn't have an effective infrastructure, their ERP system won't be able to give the performance they need. Business Solutions Specialist explained from the consultant's side.

"They had infrastructure readiness already. That was not a big issue. because the client is already ready. They are using the cloud option. They have a separate IT and ERP team. They solved the technical issues then and there. We

did not want to worry about it. We had good support from the client side. "

As per above discussion which had with both client and consultant most of companies doesn't have any infrastructure issue when implementing ERP project. Because initially all the companies had infrastructure readiness already. Some companies used inhouse servers and some companies used cloud servers.

Minimal customization: Panorama Consulting (2011) "No customization" is one of the most common mantras we hear about ERP systems among our global client base. As ideal as a zero-customization ERP implementation may sound, the unfortunate fact is that most organizations customize their ERP systems—at least to some degree. While most executives want to manage their implementations by simply using basic configuration, setup, and personalization of the software, an overwhelming majority end up making fundamental changes to the source code.From what the consultant said from the consultant's side

"There were no big customizations like developments or addons. We have tried to go with standard SAP. There were some minor changes."

According to the Senior Application Consultant on the consultant side,

"There were no big customizations in the production module. We have used the standard one. In addition, we also give sales and finance. There were some small changes in the sales module, and we made them. Actually, there were two consultants on this project. I did the manufacturing part, and another consultant did the sales and finance part. "

Most projects have had minimal customization and have tried to give the standard ERP to the customer.

According to the previous literature, adequate IT infrastructure and minimal customization have already been discussed, and those findings match with the previous literature. The above discussed themes can be summarized by the following diagram;

RQ 3: Researcher discussed what the people factors affected ERP implementation in Sri Lankan SMEs in the manufacturing sector, and the following themes emerged under the people factors during the research study.

Education and training: End-user education is one of the most important aspects of an effective ERP implementation. Most ERP projects fail due to people-related issues. It is essential that companies allay the fears of their staff about the implementation of the ERP system and provide clarity about their changed roles and responsibilities. Organizations also need to ensure that their people are well-trained to use the software effectively (CommLab India Bloggers, 2016).

Phama manufacturer's product finance was stated from the client side.

They gave us sufficient training and they gave us on the job training as well. They had a dedicated consultant for training. "

Business Solutions Specialist stated from consultant side, when it comes to education and training, most of the parties received sufficient education and training on the UAT stage, backlog stage, and finally on the live run stage also. Most of the customers are satisfied with education and training.

Users' involvement: User participation in the development of the system can enhance understanding and commitment to ERP implementation success. User involvement in determining ERP system requirements creates a positive attitude among internal customers towards the ERP system as they are an active participant in the development and change process. (Zhang *et al.*, 2004).

Phama manufacturer's product finance was stated by the client;

"In the manufacturing department, they had previous experience with ERP implementation and they knew how to be involved with system implementation.

The researcher found that there was some resistance at some points. But, most of the users are positively involved in the ERP implementations because they have identified the benefits of the new ERP implementation and top management forces them to use the new system.

Consultants competency: This can be included, knowledge of the importance of the integrated nature of business processes, knowledge of the typical business processes and activities in an organization, ability to map organizational business processes with those in ERP, the ability to configure ERP for implementing the relevant module, the ability to determine the appropriate approach for implementing ERP, the ability to map the organizational structure with the ERP elements, implementation knowledge

(the knowledge of activities associated with installing ERP software, testing software and training), ability to prepare management reports from ERP (Scholtz, Calitz, & Cilliers, 2011)**.**

Product Finance (A) of Phama manufacturer said from client side;

"In additions, as a system, I am very happy with SAP business one. But, the problem is implementation vendor expertise. They did not guide us very well. There is no any issue with SAP business one as a ERP system. Only the issue is implementation team is week."

Manager - System support of Cosmetic beauty manufacturer stated from client side;

"Other, key factor for ERP implementation success is mapping the business into the

system. If I take mapping process, vendor did almost 99% mapping correctly. If it's not done correctly, application will not be effective"

According to this theme we can identify competency of consultant is very important factor in under people factor. Because, as per the product finance of Phama manufacturer they couldn't gain in-depth knowledge about SAP Business one ERP because, consultant doesn't have much knowledge and experience. On the other hand, Manager - System support (F) of Cosmetic beauty manufacturer says that, their project succeeded because consultant is capable and having more knowledge and experience.

Client commitment: If there is a high commitment from client side (both management and users) ERP implementation project can be success.

Manager - System support of Cosmetic beauty manufacturer declared from client side;
"I can't say, its 100% success. But its success above 95%. We are using this ERP because of this successfulness. There were some small issues with reporting areas. If I take overall, without user error, there is no any issues with the system and the application level. If we take ERP project success or failure, there should be a commitment in all level. Other thing is, if vendor, or client giving any promise, they should deliver those on time from both side. If there are any resource allocation changes, it will be negatively impact for the project."

Consultant commitment*:* Implementation consultant commitment also should be their when implementing a new ERP system.

Business Solutions Specialist expressed from consultant side.

"If I take overall, this project also a challenging project. A new challenging project that I faced. If it is industry same, there were some unique point which can be change according to this client. So, we have tried our best carried out by using minor customizations. We wanted to give client to chance to enjoy standard SAP facilities. We

have worked late hours also. Finally, we went to the final target, cut off data. It's a challengeable project. But, we have faced it successfully, finally, bring it to the end of the project. Therefore, we can say it as successful project. "

Business Analyst said from consultant side;

"Initially, time was exceeded. Some development came. IFS also didn't believe that, we can do it. Because, we were new team. Our only issue was inventory opening balance issue. Somehow, we did the reconciliation in next year from live run year and other process also going live without having any issues now. Now, we can say its success."

When considering consultant commitment, they may work late hours. They may learn and study new things, new process. Hardworking, additional working hours. Those are the things that can be identify.

According to the previous literatures, Education and training, User's involvement, Competency of consultants, Client commitment are already discussed, and those findings are match with previous literatures.

But Consultant commitment can't find in previous research hence this is a new finding. Above discussed themes can be summarized by following diagram.
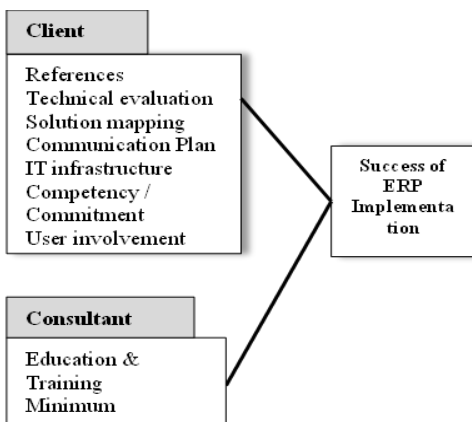

Figure 1. Mapping of success factors

4. CONCLUSION

Barbera (2015), ERP (Enterprise Resource Planning) is a business management software that allows an organization to leverage a suite of integrated applications to streamline and automate processes, creating a leaner, more accurate, and efficient operation. ERP provides complete visibility into core business processes and optimizes systems through superior resource tracking and reporting, database management, data sharing, and overall improved information systems. ERP systems can allow businesses to expand without the addition of IT or staffing costs. ERP systems enable business growth. If a company is considering implementing an ERP system, upgrading an existing system, or even if they aren't sure if they need one yet, it's worthwhile to understand the benefits that an ERP system can bring to business. Gain real-time visibility across your entire business with 24/7 access. increase the ability to understand, monitor, and control various organizational systems with unprecedented access to all facets of business. ERP can enhance business in other ways as well. makes business more agile. In a rapidly evolving business climate, being able to respond to change is essential. A good ERP system is flexible, modular, and scalable enough to adapt to shifting market dynamics and changing customer needs. A company can initially implement specific applications that make sense now and add on seamlessly integrated applications as needed as business grows. It will dramatically increase efficiency and productivity. Inefficient spreadsheets, manual workflows, and outdated software can inhibit business growth. An ERP system can streamline an entire organization and put company data all in one place, enabling more accurate reporting and a more efficient, collaboration-based, and data-driven work environment. Save on unnecessary costs. Running a business with an ERP system creates efficiencies that make a business leaner as it grows. Many businesses report that they are able to expand without adding additional staff or IT costs. The cost of implementing an ERP system is easily eclipsed by the ROI of a

more efficient, fully optimized business environment. Improve security and accessibility while reducing risk and hardware costs by moving ERP to the cloud. Embrace the future of information systems with a modern ERP hosted in a secure cloud. Moving ERP applications to the cloud allows companies to scale, extend, and upgrade quickly. It also increases visibility and accessibility even further, taking full advantage of an ERP system's capabilities. Gain a professional partner. When a company upgrades to an ERP system, it also gains the partnership of an ERP implementation provider and all the support – from implementation and training to software support to community membership – that they have to offer. Some ERP systems have dedicated user groups and communities that open up entire networks of industry innovators and dynamic brands. Grow business. An ERP system can eliminate inefficiencies, waste time and wasted resources, empowering businesses to thrive and flourish.

5. RESEARCH CONTRIBUTION

These research findings can be useful for theories of ERP implementation success factors and students seeking ERP knowledge, as well as future researchers.The findings of this research and the suggested model will be useful for every SMEs in the manufacturing sector as well as other sectors in Sri Lanka that are going to implement ERP systems, SMEs in the manufacturing sector as well as other sectors which expect to re-implementation projects as well as parties. Moreover, when we are considering client-side participants, mainly management, they can use the newly implemented ERP system to take their decisions very quickly. Because, they can generate several reports and dashboards in any module at any time, which are linked with all related modules within a short time period, and can take decisions quickly based on those. On the other hand, from the user's perspective, a lot of manual work can be automated when they are working with an ERP system. So, they can save time and use their time effectively and

efficiently. When considering the whole business process, productivity, efficiency, and effectiveness will be improved when considering before implementing the ERP system. Overall company growth will be increased after implementing the ERP system. And also, from the vendor's side, their reputation will be enhanced after completing a successful ERP project. Because the client will also recommend this vendor to other companies, it is a well-known ERP vendor in the industry. So, the ERP vendor can get more sales on this. When considering the whole economy of the country, when improving this ERP industry, Sri Lanka's service sector will considerably improve.

6. LIMITATIONS OF THE RESEARCH

This study is a cross-sectional study and it only represents the perspectives of respondents at the time of the interview. If it's a longitudinal study, we can find the respondents' different responses in different time gaps. On the other hand, the researcher conducted these interviews over the phone due to some issues. If there was any capability to meet each client and consultant in their office locations or any suitable locations, the researcher could gain more reliable and detailed data from the respondent than gathered details. On the other hand, this study is limited to the Sri Lankan manufacturing sector on a small and medium scale only. It doesn't consider service industries, large scale enterprises. **Future directions:** Future researchers may focus on finding out the level of practice of identified factors with respect to different industries. If future researchers can do longitudinal studies in different time gaps like pre-implementation, implementation, and post-implementation, the resulting data will be more detailed than this kind of cross-sectional study. Researchers discussed only two factors under technological factors and only one factor was discussed under project management factors. But, previous researchers have proposed many sub factors under technological factors and under project management. Therefore, future

researchers can find more factors under these two.

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Securing Communication of A Wireless Network in An IOT Based Precision Agricultural Farm with New Normal Work Culture.

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ABSTRACT

COVID-19 was declared as a pandemic by the World Health Organization after its breakout in the city Wuhan in China. This disease has negatively affected not only the daily life but also the global economy. In Sri Lanka out of many other fields, agriculture can be considered as one of the important economic fields as well as in the other countries that has been affected by COVID-19. This field face various types of issues. among them, security plays a major role. This security is not in terms of resources or from insects, but in the area of protection of the data that is being transmitted through a wireless network for the farmer to monitor the conditions such as humidity, water level. Now a day's cyber threats are one of the biggest discussions. Malicious attackers have taken the fully advantage of the COVID-19 situation to launch attacks for their competitive and financial gains. Farmers in modern days use the real time data that they receive through different sensors to get decisions regarding the crops and plants. COVID-19 is a reason we should practice social distancing. Therefore, doing these agriculturally based activities using different technologies without manually involving is also important because of the critical situation.

The main objective of this research paper is to identify security threats that can occur in a precision agricultural farm with third party involvements and introduce a security solution

1. INTRODUCTION

PA[1] generate different types of large volumes of data that is open to many security risks that can affect data confidentiality, integrity. The problem is that most of the situations' farmers are unaware of these security risks and does not pay attention on providing proper security methods on the network. there are many other risks and vulnerabilities as well. The danger is that even if we discover it, there is a possibility of them occurring often after they have been exploit. the security of the communication between the devices, protecting confidential data for the future purposes, secured real-time data monitoring for the farmers to make right decisions, are very important. because now a days in the society we mostly hear issues about cybercrimes, data stealing, manipulating data to gain personal needs etc. Therefore, it proves that security based on the automated and technological resources are also important just as the physical security that people mostly focus on. In this broader scale problem, this project hopes to throw a spotlight regarding security of node to node transmission in a wireless environment. In a wireless network, it is more vulnerable to attacks such as DOS attacks, sinkhole attacks.

As a solution to this security problem that we have faced partly because of COVID-19, and to have more efficient transmission, we can use different IoT related communication security methods in agricultural field. Out of all those methods this research paper will be hoping to provide the solution by securing the

communication channel between the devices when data is being transmitted and providing a security infrastructure.

2. PRECISION AGRICULTURE

Precision agriculture is an approach that used by farm management with information technology in order to make sure that the health and productivity needed by the crops and soil receives it properly. ensuring the environment protection, profitability and sustainability are the goals of PA. another name for PA is satellite agriculture. This is an agriculture area that is specialized with different software, IT technology and other equipment. This includes the real time data monitoring and accessing regarding the crops, soil, and ambient air conditions. Not only that, but also other data that are relevant to the agriculture business such as weather predictions, availability of the equipment and cost of the labors.

2.1. How Security is important to Precision agriculture.

The motivation for this research comes with the desire of having the same way of protection for the area of precision agriculture as how the other industrial critical infrastructure components are having protection. All the agents in this field should be aware that their products, data, and finances has many potential risks. This aims to make sure that the use of IoT in agricultural area, industrial sensors and the adapted technologies means that this area is vulnerable to risks and it is not associated normally with the technology use or the risks are same as to those of industry in general. Lot of research has been done regarding industrial risks, and the use of technology in agriculture, but there are very limited researches on agricultural network security risks. variety of embedded and connected technologies are employed by precision agriculture that rely on remote sensing, and communication systems to generate big data, data analytics, and machine learning. Inputs of livestock and agricultural management such as Fertilizer, seeds and pesticides are allowed for more precise application by these technologies even though it results in lesser costs and

improved yields. The biggest problem in agricultural field is, the digital area that is being advancing is more open to risks. There are research that has been done on the topic of cyber attacks in this agricultural field, but it has purely looked at this issue from a conventional attack perspective and diagnosed via network traffic.

The concept of PA is more than just GPS monitoring on a tractor, or sensors detecting temperature in a greenhouse. The data that is being retrieved from these sensors needs to be secured as well. the decisions and actions taken are important. For that, the correctness of these data is important. Therefore, to have more efficient and secured transmissions in agricultural field we can use different IoT related communication security methods as a solution. and will be needed to research on finding the weaknesses and protecting methods.

2.2. Security Threats to Precision Agriculture

With the increment of adoption of the precision agriculture technology, cyber threats and vulnerabilities have occurred. Any adversary could access sensitive data, steal resources, or destroy any data by exploiting these precision agriculture vulnerabilities.

1. Threats to Confidentiality - attackers can collect data through sensors intentionally and leak it to the third party or publishing the information in industry with the intention of causing damage.

2. Threats to Integrity - malicious attackers can release the false data to the public by mimicking the real farm data before or during an outbreak of livestock disease which will take months to settle, to the satisfaction of the foreign trade markets or agriculture, which affects the integrity.

2.3. How does Integrity threats financially affect the farmers?

If attacker or a competitor managed to corrupt or change the data intentionally, it critically leads for a financial loss for the farmer. Because in PA it fully depends on the decisions of the farmer where he decides all the things should be done

via the data taken by the sensors. For an example if the sensors provide wrong information on needing more water or more chemicals for the crops, and when the farmers unnecessarily provide those requirements even more than the amount that needed, it is a huge waste financially. Since for the chemicals they must pay good amount of money. Its' excessive buying and usage will lead to disadvantages financially, which will impact the business. These kinds of threats can directly affect this business of agriculture and farmer will have to face concerns as following:

- Concerns on third party (cooperate) use of and profit from on-farm data.
- Potential loss of competitive advantage.
- Value propositions are not clear (needs to be cost effective)
- To recover the mistakes happens from wrong decisions are way more costly.

Threats to Availability - If an attacker identifies any vulnerability in any equipment and choose to disrupt the machines it could lead to have issues regarding availability of the equipment. In agriculture most parameters are taken real time. And the decisions are made mostly based on those data. If in any way, the machines get disrupted it would cause a huge impact.

3. POSSIBLE TRANSMISSION TECHNOLOGIES AND TRANSMISSION SECURITY METHODS THAT CAN BE USED IN IoT ENVIRONMENT

3.1. Summarization and comparison of possible transmission technologies used in Wireless networks to transmit data.

1. Bluetooth -This technology has supplanted the WPANs cables and is a framework for short-range communications (Kumar, 2013).

2. Wi-Fi - Wi-Fi can provide exceptionally high throughput (>100 Mbps) at longer range however required high-power spending plan. WNs regularly transmit little volumes of basic information (Kumar, 2013).

3. 5G - This technology helps the diversity of devices & services by extending the mobile networks (Qualcomm, 2019).

4. Using MAC Address - This is also called as Ethernet address. In order to send and receive the data this MAC address should be unique. This is used in LANs and can be used only inside a local network. The data cannot be sent to a different network if you are using this Mac address as an identifier. But sending data to the devices in local network (layer 2) is possible with this method (Agrawal, n.d.).

3.2. Transmission Security of a Wireless Network
3.2.1. Cryptography

When we select a security method there are important factors that we should consider.
To encrypt the data in the network there are many solutions, and it should help preventing the potential attacks such as wormhole attack, information or data spoofing, message rely attack and sybil attacks.
In order to complete cryptographically and secure the network, it is necessary to implement security in every node in the network. the wireless mesh network is not wealthy in resource wise. In a way that it does not consume too much resources, the cryptographic algorithms should be designed in roust way in order to increase the network's lifetime. But also, should have better security to deal with more powerful attacks. The algorithm that uses for the encryption should be selected depending on the application's nature.
For all the encryption algorithms the main security requirements are,

- Confidentiality
- Integrity
- Authentication
- Availability.

3.3. Encryption Algorithms used to Secure Communication

1. Triple DES - Triple DES was intended to supplant the original Data Encryption Standard (DES) algorithm, which was easy for the hackers to defeat with ease. No. of

56 bits each with three keys that are individual.

2. RSA - This can be used in the information that encoded is being sent through a web application.
3. AES – In 128-bit form, this is very efficient. For heavy duty encryption purposes AES also uses keys of 192 and 256 bits.

3.4. Network Security Protocols used for a Secure Communication

1. IPSEC and VPN - encrypted data can be sent between two endpoints using IPsec tunneling and setting u circuits. likewise, with the connection of VPN; application layer data encoding; and also, for the routers that sends data through the public internet security is provided (Rouse, 2018).
2. VPN Tunneling - In order to apply encryption, VPN needs something more than a couple of keys. In VPN tunneling the PCs that are in both sides of the tunnel, encode the data that comes and decrypt it in the other end (Tyson, 2019).
3. TLS and SSL - Secure Sockets Layer (SSL) and Transport Layer Security (TLS) are cryptographic security protocols. They are utilized to ensure that network communication is secure (Tyson, 2019)

3.5 Technological Feasible in Providing Secure Precision Agriculture

As the transformation of digital area reaches out into business tasks, both on the online and in a world loaded with physical devices, security of Internet of Things (IoT) cannot be an idea to ignore. Numerous ventures including agriculture are now enhancing with IoT.

However, with the given exposure to IoT for the real world, it is creating a massive barrier to digital transformation by being vulnerable to security threats. The following shows few of the security attacks happened over the recent years. (Arm, 2020)

- malware loaded on to IoT devices has increased in 300%
- IoT device attacks has increased in 600%

Without having proper security in IoT, there is a risk for the brand reputations of the organization. the reliability of the data that is retrieving from the sensors in a farm is why the system is running. Because of that wanting to have a better security method to avoid the attacks that can occur to be a threat to the reliability of data is critically important. As an example,

- The chemical readings given by the sensors to the farmer is very essential because via that data the farmer decides how much chemical will be needed for the harvest and etc. if any of these parameters was given wrong or corrupted data it will affect the decisions which also will lead to financial losses. If we go further, it will also affect the brand reputations as well. since many attackers taking advantage of COVID-19 situation to perform security attacks, we should be more careful.

Gateways that associate IoT devices to organization and manufacture networks must be secured as well as the devices themselves. Also, we must mainly focus on both application level and communication level security (Dickson, 2015)

4. LITERATURE REVIEW

According to Lin (2012), was mentioned that hop-by-hop and end-to-end solutions are aggregation security solutions. To the first method, which is hop-by-hop cryptography is applied. In that, security services are checked for each step. By using this method to secure the communication in the agricultural farm, it allows to simple implementation of aggregate functions and also gives limitless on the nature. They also have used an encryption algorithm called privacy homomorphic encryption.

According to the project of Biplab Raj Sheshtra and K. Raghava Rao, they have used a Multipath routing to secure the communication in the wireless network. They state that this routing protocol helps to find the optimal path between

the source and destination nodes. And it increases the probability of reliable data transmission. Other than these there are many other methods such as using protocols such as HTTPS, TLS. And also, VPN tunneling. In addition, encryption techniques such as RSA, Blow fish, two fish also can be used. Cryptography is also one from many options (Richards, 2018).

5. SUGGESTED SOLUTION FOR THE PROBLEM

our solution for the problem is to create a secure communication channel to protect the data transmission between sensor nodes. For that we suggest a self-written encryption pattern Because, encryption can protect information with cryptography via a code that is scrambled. For that, a simple self-written encryption technique (code) which was written using C language was used instead of using a standard method that already using in the world. A part of the encrypt technique works as below.

char Ref [94] = {'0', '1', '2', '3', '4', '5', '6', '7', '8', '9', 'A', 'B', 'C', 'D', 'E', 'F', 'G', 'H', 'I', 'J', 'K', 'L', 'M', 'N', 'O', 'P', 'Q', 'R', …};

int Encrypt [94] = {9, 8, 7, 6, 5, 4, 3, 2, 1, 18, 17, 16, 15, 14, 13, 12, 11, 10, 26, 25, 24, 23, 22, 21, 20, 19, 34, 33, …};

As above, we have used the method "Substitution" when creating this algorithm. The goal of using Substitution is to achieve "Confusion". Which means to confuse the third party on how these digits are assigned. As long as this method achieve the project objective and creating a secure communication channel, we can consider it as a successful and a practical solution. With few modifications it is possible to use this method in larger agricultural farms. Also, this method can be easily used in IoT devices in the farm which is the main point of the research. According to this, each character is assigned a number and when the data is being transmitted according to the sensor readings and its' character it will change to numbers as above. we have replaced these above characters according

to our own custom pattern to a specific order. It will be further explained below.
Ex:

0 1 2 3 4 5 6 7 ….(Plain text)
↓ ↓ ↓ ↓ ↓ ↓ ↓   ↓
9 8 7 6 5 4 3 2 …(Cipher text)

- An example of how the plain text that transmits between the nodes will be turned into an unreadable data with this encrypted technique,

  Plain text: Temp = 33.17, Pressure = 1009.6, humidity = 33.65

  Encrypted message = 5590828991890559034

Therefore, even if the attackers try to interrupt, they will not understand what this encrypted message is. which makes this communication secured. This same method can be used in multiple nodes of a network which allows the communication of a network of multiple nodes to be secured.

This is a self-written encryption pattern that we have used to include to the demonstration product of the project. the reason for using a simple algorithm is that this will be used in an agricultural farm to protect sensor data.

Sensor data are very small digits, using too complicated and complex methods would be too much and unnecessary. And the attackers are aware of how to break the standard algorithm patterns since it has been using by the people frequently. Also, we use these with small IOT equipment. Therefore, using advanced methods may not support with the equipment.

5.1. Development and Implementation of the demonstration product

- Implementing a secure Node to node wireless communication between the nodes.

This is an IoT related project based on Arduino. Using Arduino, the node to node communication between the devices are created. For that purpose, Arduino IDE 1.8.12 software is used.

To develop the node-to-node communication, Arduino components such as ESP32 boards, BMP 280 sensors, USB cables, OLED Displays were used. When developing the project, we built up a two-way communication between two sensor nodes that could happen in an agricultural farm using the protocol ESPNOW.
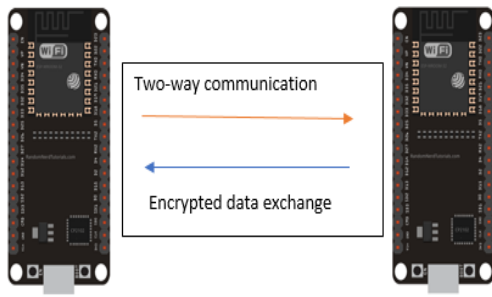

Figure 1. Two-way communication structure

This protocol can be used to communicate between multiple devices even without the use of Wi-fi. we included the self-written encryption pattern that was mentioned previously inside to the ESP32 boards. Which makes the data to get encrypted before the transmission and it is getting encrypted within the two boards making a secure communication channel. To indicate how nodes securely communicates with each other in a mesh network in the demonstration and to prove our concept of encrypting the data, this method has been followed.
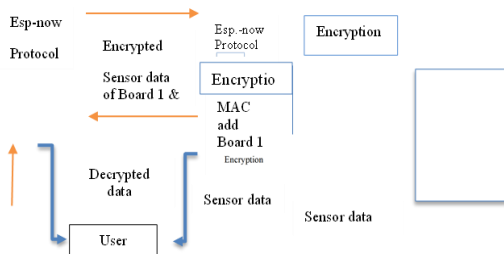

Figure 2. Process of the Demonstration Product

According to the above figure, this encryption will be included inside an ESP32 board which is the start of the data transmission. and after encrypting inside the board the data will be transmit **as block cipher** which means the data will transmit as a bundle, not separately. But

when it decrypted and displays at the end user it will be separated and clear. In our project data will not be displayed to the end user if it did not get decrypted properly.
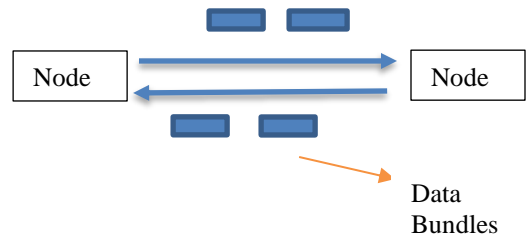
Figure 3. Sending encrypted data as a bundle

Sending the data as block cipher is another trick that is being used to confuse the attackers since it will be hard for them to identify what data is this and how many parameters are there. Only the receiver's party will know the data in detail.

6. FUTURE IMPLEMENTATIONS

This project which we have done is only based on securing node to node communication of a wireless network in a precision agricultural farm. Since security is a very broader area, security implementations should be added to the network for the areas such as node identification, authentication and data storing. Security implementations for the IoT devices, system applications, central systems also should be added. Security monitoring systems should be implemented. Securing the configurations for hardware and software applications in the network is also important. Unauthorized access should be identified immediately without any delays. A separate set of nodes should be defined for the separate parts of the farm, only those nodes will work the respective part of the farm.

6.1 Recommendations

The recommendations are to do more researchers regarding security threats in PA and be more educated regarding the topic. Even though PA has so far not been viewed as a target. This industry has commercial and strategic value much like many other different industries that have been subject to exploits, to ignore this is not

good. Especially when the attackers take advantage of the current COVID-19 pandemic. Even though there are many existing measures taken to secure these vulnerabilities, according to the saying of Cory Doctorow "any person can invent a security system so clever that she or he can't think of how to break it" (Doctorow, 2004) . proving the fact that this is not a minor issue in today's world.

7. CONCLUSIONS

This research has led to the awareness expansion of the risks that can be associated with Precision agriculture with COVID-19 situation. The lack of cybersecurity awareness is very massive problem that we have identified through this research. even though people are aware and understands that there are cyber security threats such has hacking computers, phishing emails, some people are not aware that PA is also a major area that should have proper security precautions not only physically but also technologically. we have suggested a partial solution of using a self-written encryption method to create the secure communication channel. few testings were done with the solution that we suggested, and it successfully encrypts and provides a secure communication channel which concludes that the solution is a practical method. Also, with several future enhancements this project can be massively successful.

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Traffic COP: Smart Spot Fine Management System for Sri Lanka Police

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ABSTRACT

Traffic COP is a smart spot fine management system designed to enhance the reliability and the convenience of collecting fines for the faults made by drivers in Sri Lanka. This requirement has been identified by gathering feedback from a sample of drivers and traffic officers in Sri Lanka. The Traffic COP is controlled by a centralized app installed on the server of the Traffic department of Sri Lanka Police. Devices are distributed among the traffic officers to read the chip in the license of drivers. Once a fault is identified, the traffic officers can feed the data to the system through the device and tablet unit. At the same time, all data are automatically updated in the central database at the department. This allows the drivers to pay their fines online without even touching money and reobtain the license easily on the spot. Traffic COP saves the time of the Traffic administration by allowing them to have detailed fine reports from the system without depending on the manual records. Since the data of the licenses of drivers have already been uploaded to the primary system, the officers can also be used to detect the fake licenses used by the drivers. This system prevents accusations against the traffic officers regarding the collection of ransom from drivers. At the same time, the system can use for both the administration of the Police and the Department of Motor Traffic to see any of the data syncing real-time on the live database.

Keywords- Traffic Cop, Spot Fine Management, Node MCU, RFID.

1. INTRODUCTION TO THE SYSTEM

1.1. Identified System Requirement

The current world is a technology-driven sphere where almost all the functions in the world are somehow linked with the latest technology. The day-to-day activities, as well as the manual administrative functions of developed states, have been totally replaced with the apps, software and tools introduced in the light of new technology.

But Sri Lanka as a developing country still passes a stage where the technology is slightly incorporated into the usual working patterns of the government and the lives of the people. In some government corporations and Institutions, the usage of the technology is at a very lower rate. When examining this matter further, the researcher has identified that there is a need to re-designing the fine System of the Police Department in Sri Lanka, which is equally important for both the Department and the drivers of the country. Accordingly, this project has been planned to eliminate the problems faced by the drivers and traffic officers within the existing fine System in the country. When considering the prevailing fine System, once a driver is fined by a traffic officer, the license of the Driver will be given back only after paying the fine from a post office. This process takes more time, and especially the drivers have to waste both time and effort to settle the fine and reobtain the license.

Within the busy life schedules of the people today, this becomes an extra burden to manage the payment of the fines. The new system introduced by the researcher aimed to bring solutions for these issues faced by the drivers. On the other hand, the traffic officers also will find it easy due to the introduction of this System.

This spot fine management system includes a web page where the access is limited to the head administration of the Police Department. All the devices given to the traffic officers of the entire territory are directly linked to the Database on the Cloud; hence each and every entry made by the traffic officers can be checked through the web page and App. It ensures the reliability of this System too. As the device available for the traffic officers has the ability to check the license validity from the data fed in the webpage of the Department, it gives an extra benefit of identification of the fake license in the country, which has been identified as a major issue in Sri Lanka today. A recent discussion over this matter is given in the below newspaper extraction.

Figure 1. Evidence regarding the need of introducing a system to identify fake licenses
Source: (Ajith Alahakon, Saliya Kumara, 2021)

1.2. Need of Developing a Smart Spot Fine Management System

According to the motor traffic law prevailing in Sri Lanka, when a driver is caught for a fault, he/she has to pay the fine to a post office and hand over the receipt to the police station which issues the fine, to obtain the license back. The main two

problems that highlighted the need to design a system related to this matter are as follows.

1. Working Hours of Post Offices are (Monday to Friday) weekdays 8.00 am. to 3.00 pm & Saturday 8.00 am to 1.30 pm only. (Anon., 2021) This would be much difficult if the post office is closed due to out of office time.

2. If the fine was received from a police station that is far away from the Driver's hometown area. Sometimes this will take two to three days to obtain the license back from the police station and it will be an immense wastage of time for the person. Suppose If a person in Jaffna made a mistake at Galle and his license was taken by the traffic officers. If he is in a hurry to go back, he will have to come on another day to obtain the license, or else he will have to look for the nearest post office to pay the fine, putting aside all his other urgent works.

The other loopholes researcher has identified in the current systems of both Sri Lanka police and the Department of motor traffic are,

1. There's no proper way to identify drivers who are always making the same mistakes and breaking traffic rules repeatedly.

2. Still, the Sri Lanka motor traffic department or criminal police section doesn't have a system to record and find vehicles' past accident history details.

3. At all police stations, they have a traffic section, and they analyze all traffic details weekly and monthly as a manual process. Then they submit it to the division traffic section and do the same thing monthly and submit it again to the head quarts. Most of the time, this full process happens manually, and they are passing information through telephone calls. This is a time taking action which has less flexibility.

Hence developing a spot fine system is important to address the following needs in order to eliminate the above-mentioned burdens.

- To reduce the time wasted for the reobtaining of the license.

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- To enhance the transparency of the fine collection process.
- To eliminate the malpractices related to the fine process.
- To make easy the documentation activities of the Department of Motor Traffic.
- To reduce the paper works related to the fine process.

1.3. **Significance of the Spot Fine System**

This spot fine system will be significantly important for the drivers to eliminate the issues in settling the funds and the traffic officers will be benefitted from the easiness and convenience of managing the fine System.

2. TRAFFIC COP - SMART SPOT FINE MANAGEMENT SYSTEM

2.1. **Planned process of the System**

As per the designed System, the process of using the device can be represented as follows.
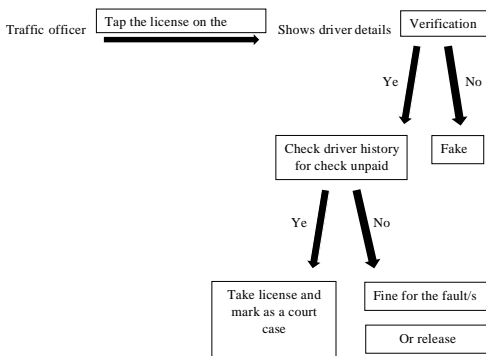

Figure 2. Planned process of the System

2.2. **Outputs of the System**

- A Webpage with license details that can be used only to one administrative user at a time on Police Head Office.
- A Device that needs to be distributed among the traffic officers to examine the license
- A website log in for the traffic officers to update the details about the errors made by the drivers and the related fine
- A Web page and Mobile App login for the drivers to check the payable fines and the

fines which have been settled earlier.

3. SYSTEM INTRODUCING

3.1. **Project Objectives**

1. To provide interoperability between issuing a spot fine by the police officer and making the payment, reobtaining the Driver's license card.
2. To analyze Driver's details and driving procedures with their past fines and inform police officers. (If the same rule breaks continuously by the same Driver)
3. Improves the efficiency and accuracy of analyzing fine statement reports and calculating the income.
4. To implement the new traffic spot fine statement management system in line with new processes, procedures linked with new technology.

3.2. **Features of the System Introducing**

The System which is developed allows,

- Drivers to make the payments online via the System (Web & Mobile App) flexibly at the location and license will not be confiscated.
- Police officers decided to settle the fine via the System or manual by considering the nature of the fault.
- Police administration and permitted police officers to view drivers, past fine records and vehicle information. (DMT also can get access if need in the future)
- Generating monthly and yearly report to be fully automated and processed information will be more accurate and efficient. The report generating process also can be set weekly or even daily if need very easily.
4. Interoperability with the existing telephone base information passing system (Police stations to division office and division offices to police Headquarters) to be more accurate

4. LITERATURE REVIEW

To transport goods services and people, the transportation plays an important role in the society, it is needed for the people to make their

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lives easier, cities and urban areas are highly crowded and the vehicle transportation comes into play and place the service as they wish, the urban areas are highly crowded with the buses, cars, bikes etc. not only in the urban areas throughout the world is crowded with the vehicles and it will bring more advantages and disadvantages to the society(Pavel & Habib Assistant Professor, nd). Due to the abundance and the capacity of the vehicles people will breach the traffic rules and the traffic officer will fine them with the increments. The research is about a system that is has been developed namely the Smart spot fine management system which will help the offender and the traffic police. In this System, the offender can pay their fine on the pot after breaching the rule and the police officer can keep the relevant records clearly up to the position. When regarding the System, the user, police and the admin performance can be listed down as follows,

User: the target audience for this project can be mentioned as the user. In the context of the project, it has been designed to make ease of the payment system. Through this System, according to this particular research, the user can create their account from their own mobile phone and can add their vehicle registration number on their own.

Admin: admin will conduct the whole process and they can be named as the coordinators of the system application They have the power to change the subjects of the application.

Police: can be named as the specific person to the System, where the officer can create their own account using their account ID and they have the authority to impose the fines according to the traffic laws and regulations. They can impose fines and keep the records clearly to maintain a proper traffic management system.

It is true that the effective implementation of the road traffic system will create the people more discipline regarding their driving and it will ensure road safety, according to Wali, et al.,

(2017) improving the traffic laws will enhance the quality of the road system in a country (Plessis et al., 2020). Traffic fines can be in two forms namely formally and informally, formally means that the fines that are imposed by the assist of the traffic official and informally suggest that the disapprovals of the offenders in the society. These traffic rules should be imposed on the society to make the individuals adjust towards the safe roadside and the government is imposing the punishments to the society to behave better in a manner regarding road safety(Plessis et al., 2020). Some of the punishments that are been imposed can be mentioned by the society can be named as the fines, penalties, confiscation of driving license, etc. and also some countries have been conducted some rewarding systems for the good behaviours of the people, in this System, the drivers will encourage there else to respect to the rules and regulations that have imposed in form of benefiting their lives. According to Ettema, Knockaert, and Verhoef, (2010) Musicant & Lotan, (2015), and Mortimer et al., (2018) has some countries are offering rewards for the people limit their travel by car in the high traffic hours and also some researchers have identified that the offers that are been introduced by the merchants will motivate the young drivers to use the smart applications to receive smart device feedback. (Plessis et al., 2020).

Fines are being allowed to the people if that breach a certain traffic law, and the particular offender should pay the fine to retrieve their driving license, so I this situation both the parties are facing numerous problems when conducting this process. According to the Sri Lankan legal law, the Motor Traffic Act (No. 31 of 1979) is the act prevailing in the society to take action s regarding improper scenarios (Perera, 2016). User or the offender is facing serious difficulties regarding paying the fine, the offender should travel to the post office to pay the fine according to the Sri Lankan legal system. Therefore the smart spot fine management system is more usable for the parties who are engaged in the situation. When regarding the system application IoT comes into play, in the System MongoDB Cloud cluster is used to transact with the user application with the user website through

API source. IOT is conducting a serious process to interact the offender with the officer.

This application is completed with a web application, a mobile app system and a separate application for the police officer to conduct their duty regarding the fine. The detailed explanation of the application has been explained in the project background and in this context, the main intention is to pave a path to the literature review regarding The real-time road traffic data management, IoT based traffic fining system, Sri Lankan legal aspect regarding motor traffic, Ensuring road safety in Sri Lanka, Acceptance of the online System in Sri Lanka.

5. PROJECT METHODOLOGY

5.1. Basic Idea of the System
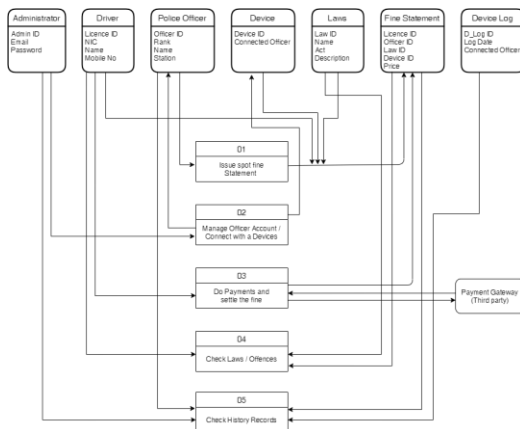
Figure 3. Basic Idea of the Device

5.2. The technologies used for the generation of the System

1. The central System is running with Node.js backend (API).
2. Used Angular for the web frontend and CSS for animations.
3. The complete Database is handled using MongoDB as distributed.
4. Devices are coded with Embedded C Language.

5.3. Software and Hardware used for the Development

1. Arduino IDE.
2. Node Server.
3. NodeMCU ESP8266 board.
4. RFID-RC522 Module.
5. Android Studio.
6. Visual Studio Code.
7. MongoDB doc-oriented cloud database.

5.4. Users ability on the system
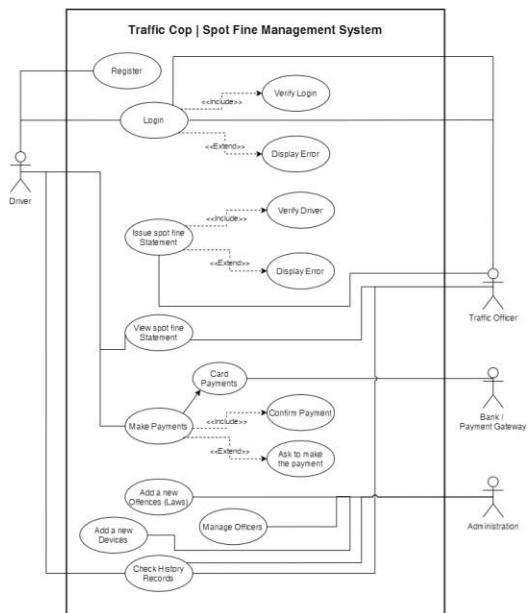
Figure 4. Use Case Diagram

6. LIMITATIONS AND RISKS

6.1. Risks identified

• It is identified that it is risky to develop this System without bugs and more securely. Otherwise, there's a possibility to make fraudulent activities from it.

• Have to access the Driver's Database and same as driving license's chip already inbuilt. But still, there's no way to read this for external people.

• Difficulty in learning/using development technologies.

6.2. **Actions were taken to eliminate risks**

- To access the driving license's chip already inbuilt. But still, there's no way to read this for external people. So, as a demo level, the Researcher planned to design it with an RFID card and receiver to do the same thing as a pilot project.

- Even though there are many resources to discover technologies and their implementations, there are fewer resources to learn best practices in relevant technologies. So, the researcher started a LinkedIn course about that field.

- To manage the schedule overrun, some tasks take more time than expected.

7. CONCLUSION

This study was carried out to introduce a smart spot fine management system, in order to ensure the efficiency of spot fine management in Sri Lanka. This electronic system and device are two innovative products introduced using Node Server, ESP8266 board, Android Studio, Visual Studio Code, MongoDB in this technology-driven world, Traffic COP will serve as another productive invention that is beneficial for both traffic officers and drivers in Sri Lanka. Concluding this study, it can be pointed out that Traffic COP smart spot fine management system is a timely important and efficient product that, comforts the lives of the citizens.

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The Impact of Supplying Flexibility of OTAs on the Attractiveness of Blind Box Travel Products

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ABSTRACT

Blind box travel products are a type of product where the intentionally hidden key information of the tour packages, sightseeing, hotel accommodations, or flight tickets could be only revealed after payment is completed by consumers. Selling blind box travel products was considered as a resilient and innovative approach for tourism, hospitality, and airline industries all over the world to survive from the pandemic since 2020 with integrating the concept of blind box craze in the toy industry originated from China. In fact, similar strategies have been popular with *Priceline.com* and *Hotwire.com* about two decades ago, which has been actively researched from the perspectives of the seller on its revenue management and strategic operations management but rarely researched from the perspectives of a consumer. This paper first defined blind box travel products and examined the flexibility and attractiveness tradeoff to provide practical insights for OTAs on designing their blind box travel products. A quantitative method was adopted in this research, the attractiveness of the blind box travel product was tested through three dimensions which are information opacity before purchase, assignment process after purchase, and consumption conditions. It was found that blind box travel products would be more attractive for consumers if there is a moderate level of information disclosed before purchase and if more

personal preferences could be considered before consumption, but different assignment processes had no significant influence on it. These findings will significantly provide instructions for practitioners to adjust their blind box travel products in a range according to their consumers' demands but also serve better for the long tail market, continue to produce economic benefits in the visible market cycle.

Keywords: **Blind Box Selling, Opacity, Product Assignment, Attractiveness**

1. INTRODUCTION

A blind box refers to a non-transparently box packed with art toys that cannot be identified from outside and these art toys are usually in series with the same style, theme, and packaging, related to films, comics, and animation, or else designed under a specific theme (Alice 2020, CAACNEWS 2020, Wong 2020, Zhang 2020, Limin 2021, Liu 2021, Wang and Zhou 2021, Zhang 2021).

In 2018 China Joy, the largest gaming and digital entertainment exhibition held in China and Asia, Tmall[1] revealed five most "burn money" hobbies for around two-thirds of young Chinese people aged between 15 to 25 years old, and one of these is garage kit[2]. Blind box products are considered localized garage kits in China towards the mass market. According to the report, 200,000 young consumers spent 20,000 *yuan* (USD 2,899)

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[1] Tmall.com is a Chinese-language website for B2C online retail, spun off from Taobao, operated in China by Alibaba Group. https://en.wikipedia.org/wiki/Tmall
[2] Refers to model figures portraying humans or other living creatures. https://en.wikipedia.org/wiki/Garage_kit

annually to purchase blind box products and the expenditure on blind box products could surpass 1 million *yuan* (USD 144,936) for consumers with the strongest purchasing power (Tmall 2019).

With the booming blind box industry in China (MobTech 2020, Research 2020) and a China-based toymaker Pop Mart's first debut in the Hong-Kong stock market (Harper 2020, Lam 2020, Tong 2020), the concept of blind box products has been identified and highlighted beyond toy industry including tourism, hospitality, and airline industries, where firms actively integrate blind box concept into travel by replacing toys with tour packages, sightseeing, hotel accommodations and flight tickets in the "box" (Government 2021).

The concept of the blind box was originated from Japan in the 19th century where initially Japanese merchants select unknown random products put in non-transparent bags selling with a substantial discount around the new year, such bags are called "Fukubukuro" or lucky bags (Huang and Yu 2014, Anderson and Celik 2020), in which trinkets, clothes, and mini figures could be found in general. There are other forms of products that employed this concept such as Gashapon (Yue 2018) and Kinder Joy (Zhang 2021).

The blind box concept is not new in the tourism industry, OTAs (Online Travel Agents) such as *Hotwire.com* and *Priceline.com* engage in such practices over decades by hiding hotel names and exact locations or airlines brands and departure/arrival times from consumers until they receive payments. The above type of selling has been defined generally as opaque selling in literature to describe a marketing practice in which important product characteristics are not revealed by sellers to consumers before receiving the payment.

Blind box selling, same as opaque selling, entails a "double-blind" process where consumers do not know the product they are about to be assigned and at the same time, the seller does not know the product preferences of the consumers (Li, Tang et. al., 2020).

Selling blind box travel products was initially introduced by the airline industry as a resilient and innovative approach to surviving from the pandemic and it became a fad around the world highlighted with a global practice during the pandemic "Flights to Nowhere" such as Australia Qantas Airway's "Mystery Flight Adventure" in which you will fly to an unknown destination with a surprise adventure day outing (Qantas 2021).

Given the increasing attention and active engagement especially from the new consumers, OTAs started to join the game by creating various types of blind box travel products. Such strategy could not only benefit OTAs in disposing of unsold inventory as a last-minute channel (Jerath, 2010, Pizam 2011) but also be used simultaneously with regular transparent channels to price discriminate heterogeneous consumers with different preferences (Jiang 2007, Fay and Xie 2008), soften price competition (Shapiro, 2008, Huang and Yu 2014) and reduce mismatches between uncertain demand and capacity (Fay 2008, Jerath, 2010).

Apparently, from the perspective of OTAs, the benefits brought by the flexibility they have on product offerings proved that blind box selling is a good revenue management technique. We take the airline blind box as an example, with only allowing consumers to select the departure location, the effect from demand uncertainty is relatively low, thus, OTAs would have high flexibility to select any airline product offered by their airline suppliers that could meet the request of the specific departure location. However, when involving consumers to influence the opacity of the product to be assigned by offering selections on destinations and departure time, OTAs would have a smaller suppliers' pool to meet the various demands, thus reducing their flexibility on product offerings.

Nevertheless, from a consumer's point of view, blind box travel products would contain several uncertainties and could be very unattractive. For example, whether a

tour departs at 7 am or 10 am might not matter for leisure travelers, but whether it goes to China or Sri Lanka probably is a game-changer, especially when consumers have rational expectations, it is never optimal to use such a strategy (Huang and Yu 2014).

Therefore, OTAs should consider adjusting their blind box travel products to consumers' demands in a range to let consumers feel they have more control of their purchases and maintain the curiosity elicited by the mystery contents to ensure continuous positive consumer outcomes (Hill, Fombelle, et al. 2016). At the same time, OTAs should also realize that such products are attractive to consumers with weak preferences (Fay 2008), or with flexible travel plans such as leisure and price-sensitive travelers (Pizam 2011), whose demands are considered as the long tail market. With the improvement of internet infrastructure and the development of consumers' knowledge and minds, there is an opportunity for OTAs to better serve this market with adjusted blind box travel products.

Therefore, when OTAs design the blind box selling strategy of their travel products, the question of how to balance products' attractiveness and the supplying flexibility arises:

1. How much information shall I reveal to consumers?

2. What kind of an opening process would be considered attractive to consumers?

3. Would it be more attractive if we allow consumers to influence product opacity before consumption?

Two main types of opaque OTAs that draw attention from researchers for the past two decades. One type, represented by Hotwire.com, posts prices for their opaque products, while the other type, represented by Priceline.com, offers a bidding pricing scheme for consumers (Name- Your-Own-Price, NYOP) where both the price and the product are opaque.

Blind box selling in this study employed

posted price model and, in this research, we will focus on pure blind box products where they are set at a uniform price but differentiated from product or service characteristics.

Based on the literature review on opaque selling and current market practices on selling blind box travel products, information opacity, assignment process, and consumption conditions have been identified as three components of the supplying flexibility of OTAs to further investigate the impacts on the attractiveness of the blind box travel products.

Through a quantitative method, it was found that it would be more attractive for consumers if there is a moderate level of information disclosed for the blind box travel products before purchase and if there are more personal preferences that could be considered before consumption. Interestingly, no matter which assignment process OTAs choose, either assign the product immediately after payment or afterward, either assign the product with limits or without, it does not influence the attractiveness of blind box travel products.

This study contributes to the literature on opaque selling in posted price model by introducing a new term blind box, and it is the first study to investigate flexibility and attractiveness tradeoff from a consumer's perspective with extra values for practitioners.

This paper is organized as follows. In Section 2, we review the related literature. In Section 3, we describe the method of this study. We present the results in Section 4 and discuss the results in Section 5. In the last Section 6, we conclude the findings and the value of this study.

2. LITERATURE REVIEW

In this section, we mainly reviewed past literature in the posted price research stream of opaque selling with a focus on opaque products' level of opacity, assignment process, and attractiveness for consumers.

2.1. **Opaque Selling in Posted Price Model**

Opaque selling refers to a marketing practice in which key product characteristics are strategically concealed by sellers to consumers until the completion of the payment.

As stated by Gönsch through his comprehensive literature research, probabilistic selling and flexible selling are interchangeable terms with opaque selling, nevertheless, different research communities with a focus on different aspects provided different definitions for this type of product under mentioned terms. Additionally, the author concluded all these similar terms are under the umbrella term Incompletely Specified Products (ICSPs) in which the seller retains the right to specify some details of the product or service after the sale (Gönsch 2020), which is consistent with the basic concept of blind box travel products whose details would be disclosed after receiving the payment.

When it comes to opaque products, they could either be vertically differentiated or horizontally differentiated (Gönsch 2020, Liu 2021). For example, almost everyone will prefer a luxury hotel offer rather than an economic hotel offer at the same price, but people do have their preferences no matter it is a luxury hotel offer or an economic hotel offer. In this study, we will focus on the horizontal attributes of the blind box travel products rather than their price differences to examine their attractiveness.

Among the studies of opaque selling, it is a common finding that opaque selling could separate consumers through their strength of preferences towards the product characteristics in the posted-price research stream.

By using a traditional hotelling model to study a game between two sellers selling products to two types of brand-loyal consumers and searchers through both an opaque channel and a traditional channel, Fay found that an opaque product appeals to searchers who have weak preferences and brand-loyal consumers purchase the opaque good only if it is offered at

a sufficient discount when the opaque channel has a large product allocation (Fay 2008). At the same time, Fay and Xie defined a new term called probabilistic selling which creates opaque products based on the seller's existing distinct products or services to sell to potential buyers as an additional purchase choice (Fay and Xie 2008). Further to the above study, by comparing advance selling with probabilistic selling, the authors concluded that probabilistic selling is about creating uncertainty in product assignment rather than consumption state. Such uncertainly in product assignment could separate heterogeneous consumers and a mid-range of strength- heterogeneity is necessary for probabilistic selling to be advantageous when the market exhibits sufficient Max_Value Heterogeneity (consumers' valuations for their preferred opaque products) (Fay and Xie 2010). Further, Rice explored the potential advantages by introducing both probabilistic selling and markdown selling strategies and found that the strength of probabilistic selling comes from the strength of consumer preferences (Rice, 2014). Similar to the above studies, Shapiro and Shi found that opaque selling enables to separate high-type (business) travelers from low-type (leisure) travelers, and by assuming that low-type consumers are less sensitive to particular characteristics of the product while vice-verse for high-type consumers, authors discussed how opaque selling influenced the competition between sellers among these two segments (Shapiro, 2008).

Besides, Jerath and Netessin explored and compared last-minute sales directly to consumers and through opaque intermediaries considering opaque selling as a strategy to dispose of unsold capacity. Authors found that when demand is uncertain, opaque selling would be more profitable when consumer valuations are low, but when demand is high, opaque selling could help the seller to produce smaller cannibalization effects on the traditional channel (Jerath, 2010).

2.2. Level of Opacity

The level of opacity for opaque products has been discussed by Granados and Gupta with a conclusion that differences in opacity could increase profitability through empirical analysis in the airline industry. (Granados, Gupta et. al., 2008) Further, the authors conceptualized information transparency in Business-to-Consumer markets and developed a research framework for a B2C transparency strategy, in which product, price, inventory, cost, and process are the five categories of information elements that sellers could consider disclosing (Granados, Gupta et. al., 2010).

The intentionally concealed information of opaque products by the seller created mystery appeal, which triggered the curiosity of the consumers towards unknown products, Hill and Fombelle found that such curiosity, directly and indirectly, impacts consumer purchase motivation and when the level of opacity for the opaque products is moderate instead of high, theyare more attractive for consumers (Hill, Fombelle et. al., 2016).

Shapiro and Shi investigated the role of opaque selling through intermediaries with the extended model to N sellers and found that the level of opacity is associated with the number of sellers using opaque channels (Shapiro and Shi 2008).

Li found the relationship between the opacity level and the revenue. Through investigating the double-blind effect on opaque selling, authors prove that revealing the product inventory information to consumers or soliciting consumers' preferences on products lower the revenue, however, it increases revenue when the seller sells transparent and opaque products at the same time (Li, 2020).

The opacity level of the product information can be decided by the seller; however, it could also be influenced by the consumers and such products are defined as the Variable Opaque Product (VOP).

Compared with pure opaque products, VOP generates more interest (Post 2010). It was proved by the "blind booking" practice of Germany's leading low-cost airline Germanwings that VOPs enable them to obtain a new set of customers as well as witness significantly increased revenue (Post and Spann 2012). Further, by analyzing this practice, Bai and Yan investigated VOP price and opacity design as well as positioning (customer selection), especially, the opacity for VOP should be confined in a range (Bai, Yan et. al., 2015). For example, in Air New Zealand Mystery Breaks tour package, Air New Zealand allows consumers to influence the product opacity by one step, which is nominating one place you don't want to go (Zealand 2020). For consumers who are uncertain of their destinations, this exclusion approach allows them to deselect a certain number of potential product characteristics to decrease the level of opacity. Found by Lee and Khelifa, who used a multidimensional binary logit model to predict the probability of consumers selecting their destinations for an airline opaque product, destinations which are closer to the departure location and share the same language are less. attractive for consumers (Lee, Khelifa et. al., 2012). Through analysis of traveler behaviors, Mao and Liu found that leisure travelers will always exclude some choices when they purchase hotel products in the opaque channel (Mao, Liu et al., 2021). Mang found that when consumers were able to select their preferences, the less opacity allowed, the higher the quoted price for the opaque products (Mang, 2012).

2.3. Assignment Process

Sometimes the full information of the product is disclosed immediately after payment and in some situations, it is disclosed sometime after payment is made but before product consumption.

Gallego and Phillips introduced the concept of flexible products with a focus on a two-period model in which buyers purchase discounted flexible products in the first period and the specific product information

will be disclosed only during the second period (Gallego and Phillips 2004). Further to this study, Jiang observed the sellers offer opaque selling not only in the advanced period such as flexible products but also in the consumption period. Thus by focusing on a one-period model where buyers could obtain full details of the opaque/flexible products immediately after completing the payments, the author discussed the optimality of opaque selling, how to set prices and when to use opaque selling to improve profitability (Jiang 2007). Hence, we could conclude that the process of obtaining full information of the opaque product after payment includes both immediate product assignment and postponed product assignment by the seller.

Wu and Wu found that postpone assignment allows the seller to benefit from demand postponement and information updating, thus optimizing capacity and price discount decisions (Wu and Wu 2015). Gönsch emphasized that the seller could benefit from additional information if the seller assigns the product to consumers a while after the sale, thus postponed assignment potentially allows the seller additional flexibility (Gönsch 2020). However, Fay and Xie argued that immediate assignment of opaque products could be more profitable for the seller since itallows the seller to charge higher prices (Fay and Xie 2015).

2.4. The Attractiveness of Opaque Products

Chen and Yuan based in the US, without separating posted price model and price bidding model, conducted a qualitative analysis which shows a low price, a value-added deal, and a fun play with the bidding system would be attractive to consumers, and performance and hidden fees are the factors that reduce the attractiveness of the opaque products. (Yuan, 2014) Further to this study, authors illustrate consumers' willingness to pay for opaque travel products depending on perceived benefits and risks and found that value assessment plays a significant role in

their intentional buying process (Chen, 2016).

3. METHODOLOGY

In this study, we will focus on blind box travel products selling through OTAs with posted price model. Since the study examines the relationship between the supplying flexibility of OTAs and the attractiveness of the blind box travel products, a quantitative approach by questionnaire was adopted.

3.1. Research Framework

In the light of current market practices on selling blind box travel products, a detailed booking process has been presented in the below diagram.
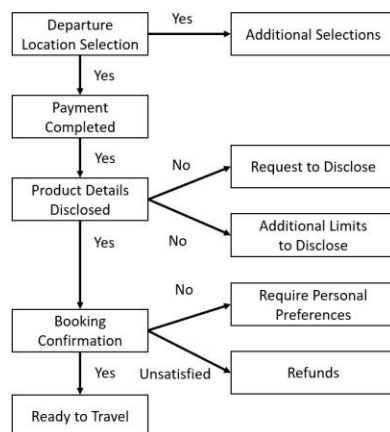
Diagram: Booking Process of Blind Box Travel Products

In blind box selling strategy, the booking process is more complex than that of the opaque products and we will take the airline blind box products offered by OTAs as an example.

In some cases, such as the airline blind box product offered by China Tongcheng-Elong (ly.com), consumers are only allowed to select departure location while all the other information is concealed; but in some other cases, the seller discloses more information such as the range of destinations and period valid for the departure time as per the practice of Ctrip.com. After completing the payment, either consumer could obtain full information about the product immediately or afterward. The former was applied by

Fliggy.com, in which a random route with a fixed date will be disclosed immediately right after the payment for consumers' confirmation. Similarly, Qunar.com will also disclose 1 random route right after the purchase, however, it offers an additional choice that if consumers are unsatisfied with the assigned route, they could disclose a maximum of 10 routes if they could convince 10 friends of them to share the product. Once consumers obtain the full details of the product, they are requested to pick a preferred date and time before consumption. And if you are not satisfied with the product assigned, there is a flexible refund policy among all the above-mentioned OTAs for you to claim refunds before confirmation.

Based on the booking process of blind box travel products shown above and the literature review (Section 2), this research extracted 3 factors to indicate the supplying flexibility of OTAs: information opacity, assignment process, and consumption conditions to further investigate how they influence the attractiveness of the blind box travel products.

According to the basic operationalization below, the attractiveness of the blind box travel products is considered as the dependent variable, and the supplying flexibility of OTAs will be measured through three independent variables.
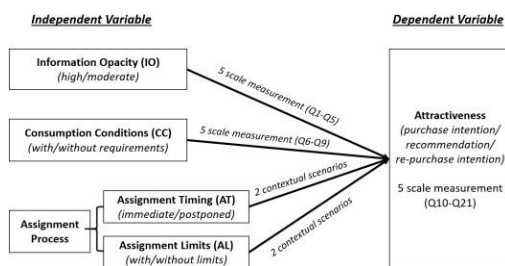
Basic operationalization of this study

The first independent variable is information opacity which refers to the amount of product information disclosed. In practice, Hotwire.com offered airline tickets with two levels of opacity: at the opaque level with the cheapest price option, no product information is provided except departure location and

destination while at the semi-opaque level with a midrange price option, approximate departure times are revealed. (Granados, Gupta et. al., 2010). Thus, we assume that the information opacity in our study has two levels, the high level, and the moderate level, where the former only departure locations are provided, while the latter more information such as destinations, time and duration, or even experiences would be provided. Therefore, the first hypothesis in this study is:

H1: There is a relationship between information opacity and attractiveness, and different levels of information opacity will have different impacts on attractiveness.

The second independent variable is consumption conditions, meaning the personal preferences or requirements given by consumers to confirm the selected blind box travel products before consumption, thus the second hypothesis in this study is:

H2: There is a relationship between consumption conditions and attractiveness. It would be more attractive for consumers if there are more personal preferences could be considered.

The third independent variable is the assignment process, which was assessed through two scales. Assignment timing refers to the time spot the OTA decides to assign the blind box travel products to consumers, which could be either immediate assignment or postponed assignment after receiving the payments; assignment limits

refer to the additional restrictions set by the seller for consumers to access the full information of the product. Thus our third hypothesis in this study is:

H3: The assignment process of the blind box travel products has an impact on its attractiveness.

3.2. Sampling and Data Collection

The sampling method applied in this study was purposive nonprobability sampling. The targeted population for this study was Chinese consumers within China who have

the habit of purchasing travel products online through OTAs. One filter question was set to ensure the respondents met the criteria. At the same time, all the respondents were explained the term blind box travel products with examples available in the market to ensure they have a better understanding of the topic before answering the questionnaire. Meantime, this research set a condition for respondents that they must assume that they have no preferences for their next travel when they are answering the questionnaire to ensure the results are not biased. The data was collected between 1 July and 10 August 2021.

Schreiber, Nora, Stage, Barlow, and King suggested that the consensus role of sample size in a structural equation modeling analysis should be 10 per estimated parameter (Schreiber, Nora et. al., 2006). There were 24 estimated parameters in this study, and a total of 257 respondents responded to the questionnaire distributed randomly online through *WeChat*, a popular Chinese social media platform. However, 14 questionnaires were deemed invalid because of the significantly short responding time, thus there were 243 valid questionnaires for this study that could be considered acceptable.

The questionnaire was developed based on the literature as well as the market practices.

First, the respondents were asked about their gender, age, and whether they have purchased any blind box travel products through OTAs before. Second, the respondents were requested to rate their agreement under the five-point Likert scale (1 = 'strongly disagree' to 5 = 'strongly agree') on the two independent variables which are information opacity with 5 explanatory questions

and consumption conditions with 4 explanatory questions. Besides, 4 contextual scenarios were designed under the assignment process variable with two dimensions assignment timing and assignment limits to collect agreement ratings on the attractiveness dependent variable.

3.3. **Analytical Strategy**

Primarily, descriptive statistics were used to analyze the demographics and variables, where the former helps to analyze the basic features of the data collected while the latter helps in understanding the distribution normality. Second, the validity and reliability analyses were conducted to prove the questionnaire designed was reliable and valid suitable to conduct further study. Then, Pearson correlation analysis, multiple linear regression analyses and two-way ANOVA analyses were conducted to determine the relationships between independent variables and the dependent variable.

4. RESULTS

4.1. **Descriptive Statistics**

Table 1 below summarizes the demographic variables of the total 243 respondents who have given valid answers to the questionnaire.

Table 1. *Descriptive Statistics for Demographic Variables*

Demographics	Categories	N	%
Gender	Male	92	37.9
	Female	151	62.1
	Total	**243**	**100**
Age	18-24	19	7.8
	25-34	151	62.1
	35-44	54	22.2
	45-54	9	3.7
	≥55	10	4.1
	Total	**243**	**100**
Past purchase	Yes	167	68.7
	No	76	31.3
	Total	**243**	**100**

It is noted that 37.9% of the respondents are males and 62.1% are females. Further, 7.8% of the respondents were aged from 18 to 24 and another 62.1% of the respondents from 25 to 34, followed by 35 to 44 age group representing 22.2% of the respondents. 3.7% of the respondents were aged from 45 to 55 and the remaining 4.1% were from the age group 55 and above.

Besides, 68.7% of the respondents purchased blind box travel products before while31.3% have not purchased any yet. The above information shows that the sample is heterogeneous, having a diverse representation.

The descriptive statistical results of independent and dependent variables are shown in Table 2, according to Waternasus, if the absolute value of *Skewness* is less than 3 and the absolute value of *Kurtosis* is less than 8, the data conforms to the multivariate normal distribution (Waternaux 1976). We could observe that the maximum absolute value of *Skewness* is 1.165 (<3) and *Kurtosis* is 2.476 (<8), thus we could conclude that the data obtained are normally distributed which sets fundamentals for regression analysis

Table 2. *Descriptive Statistics for Variables*

Items	Min.	Max.	Mean	SD	Skewness	Kurtosis
IO1	1	5	3.136	1.241	-0.195	-1.085
IO2	1	5	2.527	1.155	0.430	-0.740
IO3	1	5	2.440	1.223	0.652	-0.600
IO4	1	5	3.539	1.193	-0.388	-0.974
IO5	1	5	3.560	1.233	-0.445	-0.953
CC1	1	5	3.300	0.998	-0.356	0.157
CC2	1	5	3.868	1.016	-1.020	0.671
CC3	1	5	3.708	1.061	-1.028	0.576
CC4	1	5	3.868	1.068	-1.132	0.893
A1	1	5	3.872	0.647	-1.165	2.476
A2	1	5	3.829	0.713	-1.102	1.786
A3	1	5	3.813	0.721	-1.133	1.905

The definition of these variables are indicated in Section 3.1

4.2. **Validity and Reliability**

By testing the questionnaire's validity, this study conducted *Cronbach's Alpha* for 12 items under 3 factors as below, where both individual and overall *Cronbach's Alpha* exceed 0.8, indicating that the internal consistency of the questionnaire is good, and the questionnaire is reliable.

Table 3. *Reliability Analysis*

Scales	Items	Cronbach's Alpha	
IO	5	0.883	
CC	4	0.864	0.837
A	3	0.966	

The definition of these variables are indicated in Section 3.1

Further, the x² value of *Bartlett's Test of Sphericity* for the above 12 items is 2286.339 (*df*=66, *sig*=0.000) which proved that it is necessary to conduct factor analysis. Besides, the *KMO* value is 0.857 indicating that this research is suitable to conduct factor analysis. Further, 3 common factors have been extracted and the cumulative explanatory variance is 76.693% (>60%). To further clarify the structure of each common

factor, we use the *Varimax* method to perform the orthogonal rotation as below and we could observe 3 factors the same as designed in this research, and the factor loadings of all the items under each factor are above 0.5, which indicates that the structure of the questionnaire variable part has high validity.

Table 4. *Rotated Component Matrix*
Error **collinearity Statistics**

	Component		
	1	2	3
IO1	**.817**	.318	-.150
IO2	**.766**	.122	-.181
IO3	**.766**	.080	.034
IO4	**.761**	.412	-.080
IO5	**.756**	.426	-.083
CC1	.264	**.727**	-.085
CC2	.123	**.870**	.048
CC3	.344	**.771**	.010
CC4	.209	**.846**	-.041
A1	-.101	.032	**.963**
A2	-.098	-.034	**.967**
A3	-.092	-.060	**.959**

The definition of these variables are indicated in Section 3.1

4.3. **Relationship Analyses**

Table 5 below shows that independent variables information opacity has a negative significant association (r=-0.210, p<0.01) with attractiveness, however, the relationship between consumption conditions and attractiveness is not significant (p>0.05).

Table 5. *Correlation Matrix (N=243)*

Variables	1	2	3
1. Attractiveness	1		
2.IO	-0.210**	1	
3. CC	-0.066	0.574**	1

The definition of these variables is indicated in Section 3.1
*p<0.05; **p<0.01

Multiple linear regression was calculated to predict the dependent variable attractiveness of the blind box travel products based on 2 independent variables information opacity and consumption conditions by adding gender, age, and purchase history as control variables. A significant regression equation was found (F=25.492, p<0.01), and 33.6% of the variation of the dependent variable

attractiveness can be explained by at least one of the above independent variables (Adjusted R^2 = 0.336). Moreover, according to the VIF values of each variable which is all less than 5 as Table 6 states below, there

is no multicollinearity problem for the model

History

The definition of these variables is indicated in Section

	β	Std.	Beta	p Tolerance		VIF
Intercept	4.401	0.245		0.000**		
IO	-0.135	0.044	0.202	0.002**	0.644	1.553
CC	0.115	0.049	0.150	0.021*	0.655	1.526
Gender	0.100	0.072	0.073	0.166	0.994	1.006
Age	0.103	0.044	0.130	0.019*	0.901	1.110
Purchase	0.822	0.080	0.572	0.000**	0.888	1.126

3.1

*$p<0.05$; **$p<0.01$

The above regression analysis shows that information opacity (β=-0.135, $p<0.01$) presents a negative significant impact while consumption conditions (β=0.115, $p<0.05$) presents a positive significant impact on the attractiveness of the blind box travel product, and information opacity has more influences than consumption conditions towards the attractiveness.

As noted, there is a systematic significant ($p<0.01$) negative relationship between information opacity and attractiveness as was the case in the results under correlation analysis. However, when age and purchase history were included as control variables, consumption conditions showed a significant impact on the attractiveness of the blind box travel product.

The attractiveness of the blind box travel products was subjected to a two-way analysis of the independent variable assignment process which has two levels of assignment timing (immediate and postpone) and two levels of assignment limits (with limits, without limits). The main effects of both assignment timing (F=1.017, $p>0.05$) and assignment limits (F=2.595, $p>0.05$) were non-significant.

Table 7. *Two-way ANOVA Analysis*

Source	Sum of Squares	df	Mean Square	F	p
Residuals	370.545	965	0.384		

The definition of these variables are indicated in Section

Source	Sum of Squares	df	Mean Square	F	p
(Intercept)	609.049	1	609.049	1586.131	0.000**
AL	0.996	1	0.996	2.595	0.108
AT	0.390	1	0.390	1.017	0.314
Gender	1.932	1	1.932	5.032	0.025*
Age	4.180	1	4.180	10.886	0.001**
History	133.391	1	133.391	347.386	0.000**

3.1

R^2: 0.275 (Adjusted R^2 = 0.271)

*$p<0.05$; **$p<0.01$

5. DISCUSSION

Similar to the findings of Hill and Fombelle on information opacity for the opaque products (Hill et al., 2016), this study reports that there was a relationship between information opacity and attractiveness, and a moderate level of information opacity for the blind box travel products tend to be more attractive for consumers. Differently, this study concluded this finding through the analysis of flexibility and attractiveness tradeoff rather than consumption psychology. Besides, there was also a relationship between consumption conditions and attractiveness, in which consumers found it more attractive if OTAs could allow them to provide more personal preferences before confirmation, which is also similar to what has been found related to the interests consumers have on variable opaque products over pure opaque products (Post, 2010).

However, contrary to the general opinions on original blind box products whose attractiveness lies highly in the excitement provided right after purchase, the attractiveness of blind box travel products is not related to the assignment process. For example, whether you could obtain the full information of the offer right after payment or sometime after, or whether there are additional steps for you to access the full product information doesn't matter when you make your purchase decisions.

However, there are some limitations to this study.

According to the correlation analysis, for the consumers who have purchased before, blind box travel products tend to be less attractive ($r=-0.555$, $p<0.01$). The question therefore is whether we could obtain the same results from consumers who have not purchased any blind box travel products yet. Thus, future studies could focus on analyzing further on flexibility and attractiveness tradeoff by comparing two consumer groups featured by past purchase history, which could provide further instructions for practitioners to understand consumer re-purchase behaviors as well as to strategically introduce the selling strategy of blind box travel products to untapped countries and markets.

Moreover, supplying flexibility of OTAs is not only limited to product information and assignment but also flexibility on pricing, thus future studies could extend this research by including price factor to analyze the flexibility and attractiveness tradeoff.

6. CONCLUSION

Following the blind box fad created by a China-based listed toymaker Pop Mart on its art toy blind box products among Chinese young people, "blind box + travel" has become a popular practice among tourism, hospitality, and airline industries, where the intentionally hidden key information of the tour packages, sightseeing, hotel accommodations, and flight tickets could be only revealed after payment completed by consumers.

Many OTAs as well as travel service providers started to involve in initiating their own blind box selling strategy. Through current market practices and literature review on opaque selling of posted price model employed by Hotewire.com, three factors, information opacity, assignment process, and consumption conditions, have been extracted to measure the supplying flexibility of OTAs on its blind box travel products to further investigate their impacts on the attractiveness through 3 hypotheses. Through quantitative analysis, it was found that H1 and H2 are valid, where information

opacity and consumption conditions have an impact on the attractiveness of the blind box travel products. The findings show that it would be more attractive for consumers if there is a moderate level of information opacity for the blind box travel products and if there are more personal preferences that could be considered. However, contrary to the H3 where we assume the assignment process has influences on the attractiveness of the blind box travel products, it was found that there was no relationship between them, thus OTAs could select any assignment process that works best for them to maximize profits. However, OTAs should pay attention to their process selections because it could be unattractive if the learning cost of the process is high or the rules are complicated.

This study extended the literature on opaque selling in posted price model by introducing a new term blind box selling with real market examples in tourism, hospitality, and airline industries, and it is the first study to investigate flexibility and attractiveness tradeoff from a consumer's perspective rather than a seller's perspective.

Besides, this study also provides a general idea on how much flexibility OTAs could apply when selling blind box travel products to consumers to ensure continuous attractiveness and provided vital instructions for practitioners to fulfill the demand of low-frequency non-rigid customer segment, connect the marketable equity of customers in the long tail market and the marketable equity of OTAs, and continue to produce economic benefits in the visible market cycle.

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Role of Ethics in Sustainable Brand Development – Study Amongst University Students on the Effect of Ethical Communication by Consumer Brands in Sri Lanka on Brand Perception

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ABSTRACT

The present socioeconomic environment has influenced the corporates to have a significant focus on the societal and ethical commitments when developing brands. The situation is same in the context of Sri Lanka as many multinational and local conglomerates spend heavily to establish their respective consumer brands using various promotional strategies. Certain tactics used by some of them pushing the boundaries of marketing communication principles especially in the area of social marketing platforms have exposed unseen aspects of brands creating a doubt on the authenticity of what they claim. Therefore, the purpose of this study is to examine the effect of consumer's perceived ethicality on the authenticity of the marketing claims conveyed by the consumer brands in Sri Lanka in order to sustain their brand's position in the market. Based on the Brunk's Consumer Perceived Ethicality (CPE) concept, the operationalization questionnaire was developed including other salient points identified through literature on the ethical considerations in marketing. The questionnaire was distributed amongst the university students in Sri Lanka and the results were compiled using descriptive analyses. Once the data was collected, they were studied through statistical analysis. Using descriptive statistics, sample data were summarized in terms of the distribution of the data (the frequency of each score on a test), the central tendency of the data (the mean to describe the average score) and the variability of the data (the standard deviation to describe how spread out the scores is). This article discusses the findings of the research and management implications including the limitations and guidelines for future studies.

Key words- Consumer brands, Brand perception, Ethicality, Marketing communication, Sri Lanka

1.1 INTRODUCTION

The book 'Beyond branding' edited by Nicholas Ind (2003) says the Brand is where the organization most overtly interacts with people and creates the opportunity for manipulation. This is not how the marketers have defined the word branding into the society but when examining the activities conducted by certain corporates to sustain their brand positions, one cannot disregard the value of the above statement. The definition given to a brand by the American Marketing Association is: a name, term, sign, symbol, or design, or a combination of them, intended to identify the goods or services of one seller or group of sellers and differentiate them from those of competitors (Kotler, 2003). Ries and Trout (1981) explained that the corporates are

aiming to get the offering of their brands into the minds of the consumers rather just selling their products. In the contemporary business environment, the emerging question is whether those organizations executing that task under the ethical framework in order to maintain the sustainability of their brands. Brand sustainability has been identified as an important concept of the business world and is a precondition for future growth (Hofstra, 2008).

1.2 LITERATURE REVIEW

2.1. Socio Responsibility and Ethics

How Ethics are explained as the name of a branch of philosophy defined as a set of moral principles (Northouse, 2014). Moral principles Identify specific conduct as being either 'right' or 'wrong'. Therefore, even in the activities related in marketing for building sustainable brands, there are accepted principles that define what is right and wrong. Social responsibility is closely related to ethics because social responsibility relating to ethics includes social relationships within society, in which enterprises work (Goolsby & Hunt, 1982; Hur et al., 2014; Sen et al., 2006). Under the intense competition amongst the marketers to win customers, marketing communication is used as a powerful tool to bombard target customers with plethora of various options to select from. One can argue that it is a positive factor as the consumers are given the choice of a wide variety. Also some can argue that it confuses the consumer pushing them to invest more time and effort to select the best value for money. Under the context of Fast-Moving Consumer Goods (FMCG), this can have a greater effect by virtue of the product itself. Because, FMCG markets are defined as relatively inexpensive, frequently purchased and rapidly consumed items on which buyers exert only minimal purchasing effort (Dibb, 2006). This is where the point discussed at the beginning of this article comes into the effect. Can corporates use their branding to manipulate consumers? Is this ethically acceptable?

2.2. Ethical Brands

In Ethical brand has been defined as a brand that represents a company, organization or person whose products, services and activities are morally correct (Gibbons, 2020). Many corporate scandals have shocked the world and has changed the way consumers look at commercial organizations. It has converted the hungry consumer to an ethical watchdog (Roddick, 2012). These changes in the consumer behavior have influenced organizations to incorporate moral criteria in order to achieve competitive advantage on a brand influencing consumer perceptions (Mulki & Jaramillo, 2011). Ethical branding, as a subset of ethical marketing, relates to certain moral principles that define right and wrong behavior in branding decisions. A brand needs to be evaluated not just by the economic or financial criteria but also by the moral ones. An ethical brand should not harm public good; instead it should contribute to or help promote public good (Fan, 2005).

2.3. Ethical Marketing Practice

The Ethical marketing practices supposed to be enlightening managers and marketers with a guideline concerning what they should do when they face an ethical problem (Dunfee et al., 1999). Ethical Marketing has been defined as a code of morals and conduct used in marketing practices (Gaski, 1999). Some scholars have gone to the extent of explaining it as how moral standards are executed on marketing decisions (Abela & Murphy, 2008). These principles have spread to the other parts of the world from the USA and Europe and Sri Lanka is not an exception. With the digital marketing, much information whether right or wrong are reaching consumers creating many doubts on their favorite brands. It influences mainly youth to question the status quo and discuss those points openly and sometimes, use social media to express their vociferous ideas to the public. Ethical norms in Sri Lanka emphasize giving back to the local community, respectable and abstinent behavior, and education (Goger, 2013). The awareness of

ethicality surrounding brands and the respective marketing process is generally well understood by younger audiences in markets such as the United States (Marcos, 2020). However, in the Sri Lankan context as much as businesses engage in its ethical business practices, there is also a need to develop a clear communicational channel through forms such as electronic media, print as well as client engagement to build a platform to spread the activities of the business (Wijewardena and Herat, 2020). There is a knowledge gap as the attention of the researchers on the ethical aspects related to consumer marketing in Sri Lanka is minimal. Many scholars have suggested more studies on the subject in different contexts (Lee & Jin, 2019; Singh et al., 2012; Papaluca et al., 2020).

Brand Perception

As Brand Perception is what consumers believe a product or service represents. Many studies have proven beyond doubts that advertising have a significant effect on building consumer's brand perception (Ayanwale, 2005; Jun et al., 2009; Mela et al., 1997). Most of the time, what companies say and how they say attribute to the building of brand perception. However, what a brand truly delivers build the perception of the brand amongst the consumers over and above what the company says. It depends on their use, experience and the brand's functionality. The brand perception is directly linked with the consumer's purchase intent (Martinez, 2012). The value of conducting a good, sustainable business in the long run has come under the focus of contemporary organizations as their profitability and market share are directly related to the word of mouth of customers along with their brand trust and loyalty (Soloman et al., 2006).

3. **THEORETICAL FRAMING AND HYPOTHESIS**

3.1. **The effects of Consumer Perceived Ethicality (CPE)**

The need for the brands to behave in an ethical manner has been identified by many scholars (Story and Hess, 2010). The customer expectation on brands to live and display their interests on ethics is a common phenomenon in the current market (Maxfield, 2008). Fan (2005) put in a nutshell the key elements of an ethical brand. It represents the overall brand management that overlaps on business ethics.

The model of CPE was presented by Brunk (2010) to analyze the aggregate perception of the consumers with regard to the ethical behavior of a brand and it has been suggested that the attitude of an ethical brand involves in consequentialist and non-consequentialist monitoring systems for evaluation. Socially responsible act, damaging behavior avoidance, respect on moral norms, follow the law of the country, weigh positive/negative consequences and being a good market actor are included into this considerations. This has been further developed by Shea (2010) arguing that it needs to incorporate the behavioral and affective attitudes of the consumers while maintaining the conceptualization of the cognitive component of the consumers' attitude toward the ethical behavior of the brand. When the CPE framework was incorporated by Singh et al. (2012), brand loyalty and brand affect have been included as behavioral and affective respectively as component of consumer's attitudes.

However, as this study is straightforward on examining the perceptions of young consumers on the ethicality of brand communication on Personal care products, five variables suggested by Brunk (2010) were modified and used for the questionnaire.

H1 – Consumer Perceived Ethicality (CPE) on brand has a significant impact on the brand perception

3.2. **The Effect of Promotion-Related Ethicality**

This part primarily constitutes advertising of the brand. The role of integrated marketing communication is creating and maintaining brand equity and brand identity (Madhavaram et al., 2005). On the ethical aspect, the brand

needs to do all consumer targeted marketing communications under legal legislation and there cannot be any degree of intentionally misleading or deceptive aspects (Lee & Jin, 2019). This includes the false, misleading and exaggerated advertising campaigns and refraining from providing actual and authentic ingredients and processes used while manufacturing.

To assess the effects of many variables including the promotional related ethics, Lee & Jin (2019) have proposed a framework with a tested and valid tool. They have tested all 4 P's of marketing looking at the Ethical marketing practices of product-related ethics, price-related ethics, place-related ethics, and promotion-related ethics. As the objective of this study is to ascertain the effect of the ethical aspects on consumer communication, only the Promotions related section was adopted to the study. Therefore, the following five variables were modified and used for the questionnaire.

H2 – The promotions related ethicality has a significant impact on brand perception
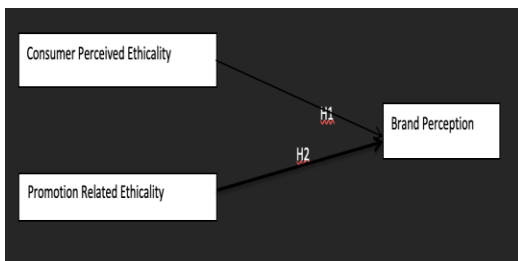
4. CONCEPTUAL FRAMEWORK

Figure 13. The impact on brand perception

5. RESEARCH METHODOLOGY AND RESULTS

5.1. Questionnaire Development and Data Collection

The questionnaire was developed taking CPE theory presented by Brunk (2010) and a part of the model developed by Lee & Jin (2019) using the overall marketing strategy to examine the effect of ethicality. They have developed that model covering all four P's in marketing but only the part that tested the effect of promotional element was considered for this study. Once the questionnaire was developed, it was distributed amongst a sample of university students studying in both local and foreign affiliated universities in Sri Lanka.

The instrument was divided into two parts, with questions related to demographic placed at the beginning. And the other part of the survey included questions on ethical business practices on the overall brand and particularly related questions on the brand's consumer communication.

The statistics shows that most university students participated for the survey are female. The percentage of female students is 64% while the male student representation was only 36%. Majority of them are between 20 to 24 years of age as that category represents 88% of the sample. Balance 12% of the students were over 24 years of age. A seven-point Likert Scale used for the questionnaire with 1 recording strongly disagree and 7 recording strongly agree.

The analyses display a situation that the sample selected for the study are not very clear in their minds regarding the role played by the FMCG companies in Sri Lanka with ethicality. All answers are summarized with an average in between 4 to 5 in the above scale. It is depicting they neither agrees nor disagrees. The only variable out of ten that has come under 'somewhat agree' with an average of 5.2 is when asked whether the Consumer Brands in Sri Lanka seem to try to create new jobs.

Table 2 – Descriptive statistics

The Consumer Brands in Sri Lanka are…	Mean	Std. Devia.
socially responsible brands	4.65	1.118
trying to create new jobs	5.20	1.010
environmentally responsible	4.21	1.347
supporting good causes	4.86	1.034
beneficial for the welfare of the society	4.52	1.241
Not providing fraudulent advertisements.	4.33	1.306
Not advertising its products as having higher quality without providing proof.	4.42	1.353

Not engaging in unethical powerful sales activities	4.68	1.504
Keeping all its promises made by the company.	4.00	1.404
Not bluffing, or making statements not based on facts	4.32	1.093

Source- Authors own

6. DISCUSSION AND CONCLUSION

The study primarily aimed to examine the perception of the younger consumers on ethicality of brand communication through the identification of advertising and the promotional tools. Based on the findings a key output to be seen is the lack of awareness of the younger consumers about the FMCG corporation ethical behaviors. This disagrees with some of the previous work which has highlighted younger consumers have a considerable knowledge when it comes to the various ethical practices of business (Mohiuddin *et al.*, 2018). However, the results correspond to previous findings of the literature that especially in a Sri Lankan context, as there is a requirement to efficiently use the media channels to spread the awareness of the ethicality practices carried out by the corporations (Wijewardena and Herat, 2020). The lack of a clear communication channels are something therefor that needs to be addressed which will have clear messages on the activities of the business is transmitted (Toledano, 2018).

Future line of work on this topic needs to identify the key channels of communication to reach the younger audiences of the country to convey the message of ethicality of business. In this way the younger audiences can become more responsible and develop their understanding of the overall impact of business in the country to become more responsible citizens.

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Emergency Alcohol Consumption Limit Detector

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ABSTRACT

Drink driving has become one of the primary root causes of the exponential growth of vehicle accidents. This heedless driving of the drunk drivers would risk and damage lives and properties, which would lead to economic redundancy. According to literature, currently, authorities are using a piece of equipment called a Breathalyzer to check the alcohol limit of the person's breath. But apparently, it is only intended for one-time use only. As a superior solution for this problem, an Emergency Alcohol Consumption level detector is proposed through this paper. This reusable system that prevents drivers from drink driving would mitigate the number of accidents and damages. This system is not only a solution to secure lives and properties from drunk drivers but will also provide ordinary people and authorities a better and new service, which will be a huge factor in elevating economic growth by increasing the standard of peoples' lives.

Keywords: Breathalyzer, Economic Growth, Arduino

1. INTRODUCTION

Nowadays, most accidents happen by the reckless driving of drunk drivers (Borrelli, (2021); Jeepura, & Pirasath, (2012); Weerawardena et al., (2013)). These heedless driving would risk and damage theirs and other peoples' lives as well as valuable properties.

The research done with the Department of Police and ordinary people helped to identify their requirements and the issues they face from drunk drivers.

Moreover, according to the research findings the authorities have been using several types of equipment to check the alcohol level of the drivers' breath. Seemingly these current systems show issues such as giving invalid results, not being reliable and not being user-friendly.

Considering all the requirements and issues, finally build a system known as **"Emergency Alcohol Consumption Limit Detector"** to prevent drunk drivers from driving the vehicle and as a solution for the defects that are shown in the current systems.

Emergency Alcohol Consumption Limit Detector is a system that consists of a circuit to measure the alcohol level of the driver's breath every 0.1 seconds, track the driver's location as well as inform the driver's loved ones when the driver is drunk via the app.

Ultimately, the main goals of this system are to be a reliable and user-friendly system to the ordinary people and for the authorities, to reduce the amount of accidents that happens due to the drunk drivers, most importantly to prevent drunk drivers from driving the vehicle and to create an innovative solution which would lead economic development by reducing the number of accidents.

1.1. Problem Identification

Three main problems stood out during the analysis that was done with the Police Department, from research articles, furthermore by talking to people via a survey as well as face to face. This section will briefly

describe the problems and how the proposed system will be a solution for the mentioned issues.

1. How to prevent drunk drivers from driving the vehicle?

This prevention has done in two separate ways.

- When the driver gets in the car already drunk, the Ethanol sensor detects that the alcohol consumption level of the driver is above the limit and the engine won't start up

- When the driver gets drunk while driving the buzzer will start to blow until the driver stops the car.

In both situations, as soon as the sensor detects the alcohol limit of the drivers' breath is high the emergency contacts will be informed that the driver is over the legal limit via a text message saying "Driver is drunk" with the driver's current location, as well as a call.

2. Will the authorities be able to catch all the drunk drivers?

As a solution for this matter, apart from the same solution that has been mentioned in the previous problem, this proposed system would display the alcohol consumption level of the driver's breath in the LCD which has been attached to the dashboard of the vehicle. This would help the authorities to check the alcohol consumption level of the driver's breath by checking the LCD and the other passengers in the vehicle can prevent the driver from driving the vehicle.

3. The existing System is not reusable, what if it gets out of stock? (Modern breathalyser machines: a shot in the arm for police, (2017))

The existing system (Breathalyzer) is a one-time use, (Cops provided with 90, 000 alcohol breathalyzer units, (2017)) which means when it uses on one person the same Breathalyzer cannot be used on another, therefore seemingly there is a chance that the

Breathalysers would be out of stock. As a solution for this matter, this proposed system is built as a reusable and user-friendly system that can be used on many people rather than disposing it away once used. Furthermore, it detects the alcohol limit of the driver's breath in each 0.1seconds.

1.2. **Parties That System Has Been Built For**

This system has been built not only for authorities but also for ordinary people as well. The following section indicates each party and how this innovation accomplishes them.

1.2.1. **Police Department**

In every country, the Police Department is the most respected department connected to road safety and the safety of the people. They would take all the necessary and possible actions (Kodikara et al., (2017)) to reduce the number of accidents and increase the safety of the people. Seemingly most of the accidents have been caused by the reckless driving of drunk drivers. Unfortunately, due to the fact of not having the proper equipment or system, authorities are unable to prevent the drunk drivers from driving the vehicle unless they get caught. This would not reduce the number of accidents and damages caused by reckless drunk drivers in a great amount, as well as this would lead to lowering the commitment of the authorities who are trying to provide for 24/7.

The breathalyzer is the existing system that has been used by the authorities to measure the alcohol consumption level of the driver's breath. Seemingly this method has several main disadvantages. Such as, this method is not reusable, often give invalid results (The Wilson Law Firm. (n.d.)) and this method can only be used when the authorities catch the drunk drivers.

This proposed system accomplishes the requirements by being a reusable and user-friendly system that updates the alcohol limit of the driver's breath in every 0.1 seconds. In addition, there are some other opportunities as follows.

- This proposed system would display the alcohol level of the driver's breath in the LCD which is attached to the dashboard where anyone can easily check whether the driver is within the legal limit by looking at the LCD.

- This system would prevent the drunk drivers from driving despite they got drunk whilst driving or they were already drunk, which would lead to reducing the number of accidents in a greater amount

1.2.2. Ordinary People

Reckless driving of drunk drivers would lead to greater risk and damage for their lives and well as others. This not only risks the drivers' lives but also it makes drivers' loved ones (family members, partner, friend) anxious.

The proposed system accomplishes the requirements by preventing drivers from driving the vehicle under a high alcohol consumption level as well as by informing emergency contacts as soon as the Ethanol sensor detects the driver's breath is above the limit

2. LITERATURE REVIEW

This section briefly discusses the different devices (Freudenrich, (2021)) that have been used to test the alcohol level in the breath and about the proposed system. Moreover, discusses how the proposed system will be a solution for all the drawbacks shown in the existing systems.

2.1. Existing Systems

1. Breathalyzer

The breathalyser (H. O. W. Alcohol , (2021); Starlight Asset. (2021); "the accuracy of breath alcohol analysis using the breathalyzer", (1985)) is one of the main systems that has been used to measure the alcohol level of the suspect's breath. This test is used as an evidential in the Police Department.

Moreover, following is the procedure to check the alcohol limit of the breath using this system. (Figure 1)

- This system uses a sample breath of the suspect
- Due to the chemical reaction with the alcohol when the breath contains Ethanol, the chemical would change colour from green to orange.
- The more Ethanol present, the greater the amount of green colour produced in the tester tube.
- When the person ethanol concentration is over the limit a distinct green color change will have occurred in the yellow crystals and progressed all the way up to the red line or beyond.
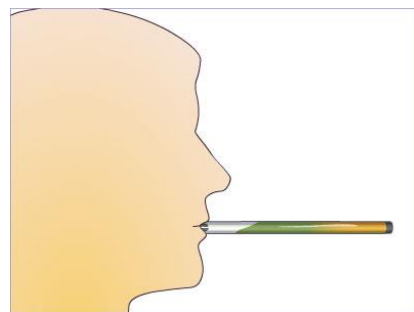

Figure 1.Chemical reaction with alcohol.

2. Alcovisor Meters

Alcovisor meter (Figure 2) works in a similar way as the Breathalyzer, Alcovisor ("the accuracy of breath alcohol analysis using the breathalyzer, (1985); Egyptian Journal of Forensic Sciences, (2016)) is used by the police department before using the Breathalyzer.

Figure 2. Alcoviser Meter.

3. Intoxilyzer

Intoxilyzer (Counterpoint, (2017)) (Figure 3) is a system that uses Infrared spectroscopy to detect alcohol. In Intoxilyzer molecules are constantly vibrating, and this vibration change when the molecule absorbs the Infrared light.

The procedure of how the Intoxilyzer works as follows.

- The lamp generates a broadband IR beam
- This broadband IR beam would pass through a sample chamber into a filter wheel.
- This filter wheel would convert ethanol into an electric pulse
- This electric pulse would be relayed to the microprocessor, which interprets the pulses and calculated the BAC
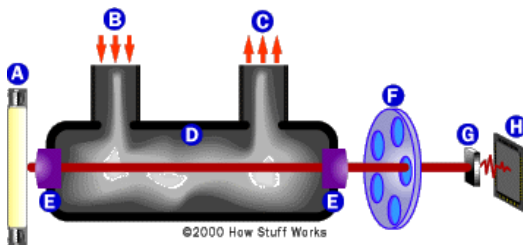
Figure 3. Intoxilyzer

2.2. Proposed System

The Proposed System which knows as **Emergency Alcohol Consumption Limit Detector** (Figure 4 & Figure 5) is a system that detects the alcohol limit at the driver's breath every 0.1 seconds.

Accordingly, as soon as the driver's breath is higher than the given limit the system will prevent the driver from driving the vehicle while informing the emergency contact that the driver's alcohol limit is higher.

This system has been designed considering all the facts, requirements, and drawbacks to be a reliable and user-friendly system for the authorities as well as for the ordinary people.

Figure 4. Emergency Alcohol Consumption Limit Detector (inside)

Figure 5. Emergency Alcohol Consumption Limit Detector (outside)
Figure 5. Structure of the proposed system

2.3. Procedure to Measure the Alcohol Limit in Person's Body

This subsection would briefly walk you through the difference procedure between the existing systems and the proposed system to measure the alcohol limit in the person's body.

One of the common existing systems known as a Breathalyzer would be used on a driver by the authorities after twenty minutes (Blog - Breathalyzers.com, 2010) of the inspection period to make sure that the driver doesn't vomit or eat anything or burb since these actions would cause provide insufficient results. Then, the officer would press the button on the handheld unit and wait until the LED displays "Blow" to ask the driver to push a consistent breath of air into the device to get a sufficient sample amount to check the alcohol result. If the result is sufficient then the breath ticket would be print (the breath ticket is known as a result paper of the drivers' alcohol result of the body). If the results are insufficient the officers maybe, ask to do it again in a new breathalyzer (2009; Illinois State Police. (2018)).Moreover, currently there are several types of breathalyzer uses in worldwide. Even though they have different principles, they all are designed to have a mouthpiece, a tube where suspects have to blow the air, and a chamber where all the air goes (How to Properly use a Breathalyzer. (n.d.) ;Mah, 2021).

In the **Emergency Alcohol Consumption Limit Detector**, at first, the driver has to register into the app using his/her name, email, and phone number, after that he/she has the opportunity to add three emergency contact numbers where he/she leads to increase safety. Once the driver is registered to the application, he/she has the opportunity to log into the app using the phone number that they have given when registering. Afterwards, the app checks whether the number is correct or not. Once it is confirmed that the number is correct the app will connect with the circuit. When the driver gets into the car already drunk or the driver gets drunk while driving, the Ethanol sensor which has been attached to the steering wheel would detect it and show in the LCD which is attached in the dashboard. As soon as it detects a high level of alcohol, ignition won't work therefore the engine won't heat up and the buzzer will start to blow. If the driver gets drunk while driving the buzzer will start to blow until the driver stops the car. As soon as the sensor detects it, the circuit will send a message, call, and the location to the Emergency Contacts that have been added to the app via Bluetooth. Last but not least, if one Emergency contact number does not answer it or cancels the call, will redirect to the next emergency contact number likewise until one contact number answers it shows an iteration procedure of sending a call.

2.4. How the Proposed System is a Solution for Drawbacks Shown in the Existing Systems?

The main scope is to build a system that is reliable, user-friendly, and most of all where the system itself would prevent drunk drivers from driving the vehicle, which would lead to increase the safety of the people. The following points will briefly describe the drawbacks of the current systems and how the outcome of the proposed system is a solution for all the drawbacks that are shown.

a. Apparently, most of the existing systems are one time use or the process takes a longer time, but this proposed system only takes 0.1 seconds to detect the alcohol limit of the drivers breath and once it has been used within 0.1 seconds it can be used again leading to increased reusability.

b. Current system often gives invalid results. (Nelson, 2017), (Drink Driving.org, 2021) The researchers have found that the people face embarrassing situations (Sri Lankan Law Report, (2007)) due to the fact there is no validity in the evidence or result.

   Following example would show you one unfair situation faced due to invalid results.

   "The accused was charged in the Magistrate's Court with having driven a motor vehicle on a highway, after he had consumed alcohol, and

caused the death of a schoolboy. Due to the fact the prosecution has failed to prove that such person had a minimum concentration of 08 grams of alcohol per 100 milliliters of blood. Accused is entitled to an acquittal on that count under the section 151 of the Motor Traffic Act. " (Sumanaratne & Gunawardana, (1991).

Seemingly these victims will face unfair situations while accused get acquittal. In proposed system by detecting the driver's breath in each 0.1 seconds, there will be a very low percentage of showing an invalid result avoiding such situations.

Existing system takes a long time to get the result (Blog - Breathalyzers.com, (2021); What Is The Procedure For The Evidential Breathalyzer Test?, (n.d)) while the proposed system shows the alcohol limit of the driver's breath instantly on the LCD which is attached in the dashboard, this would help authorities or the passengers to check whether the driver is in the condition to drive or not.

c. Existing system is only able to prevent drunk drivers from driving the vehicle if only the authorities catch them, but the proposed system itself prevent the drunk drivers from driving the vehicle.

d. In all the existing systems the driver's loved ones will get to know that the driver was drunk if they get charged or caught by the police.

But in the proposed system as soon as the Ethanol Sensor detects that the alcohol limit of the drivers' breath is high the system will direct a call and a message to the emergency contact mentioning that the driver is drunk as well as the vehicles current location.

3. BRIEF EXPLANATION FOR HOW THE SYSTEM HELPS FOR THE ECONOMIC GROWTH

1. The crashes that happen due to drink driving would lead to an increase in the economic cost for motor vehicles, lost productivity, workplace losses, medical costs, legal and court expenses which will eventually lead to the economic downturn. (K. Findings, (2017)) As a solution for the matter, the proposed system that prevents drunk drivers from driving the vehicle itself would reduce the number of crashes that happen and would limit economic downturn.

2. Due to the reusability of the proposed system, the annual expenditure of such devices would be drastically reduced. This may lead to increase in economic development.

4. SYSTEM DESIGN

This Ethanol Consumption Limit Detector consists of a circuit and an app which will be briefly described from following subsection onwards.

4.1. Circuit Design

The system contains main components such as Arduino UNO Rev3, Arduino UNO shield PCB, MQ3- Alcohol Sensor, LCD to I2C Converter, 6 X 2 LCD, Bluetooth HC-05, Buzzer, Relay, SIM800l GSM GPRS Module

4.1.1. Developed Board (Arduino Uno Rev3 and Arduino UNO shield PSB)

In the first sprint, all the components have been connected to the breadboard and checked whether if there are any failures or issues. (Figure 7). his system has undergone seven sprints and unit testing which will eventually confirm the system runs without any errors. Once the system confirms that the components had been soldered into Arduino Shield PCB to make sure that all the wires are safe and there is less chance to break. The programming has been done using c language and installed into the microprocessor in Arduino board through USB Virtual COM Port.
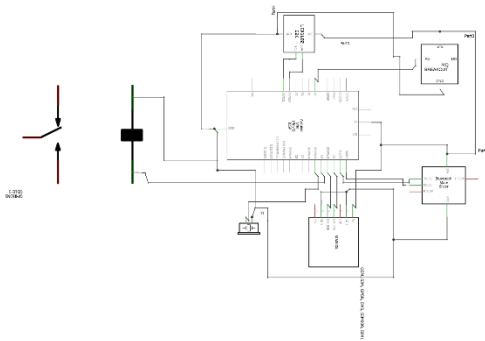
Figure 7. Unit testing using breadboard

Figure 8. Schematic of the development board

4.1.2. MQ3-Alcohol Sensor

This sensor (Engineers, L. M. (2020)), (*MQ3 Alcohol Gas Sensor Module*. (2019)) gets the input as 5V and output voltage is between 0V-5V, therefore the user can sense the variation of output voltage using any microcontroller and it can detect the presence of Alcohol. This sensor has a good sensitivity which means as soon as the alcohol gas gets closer to the sensor it detects it

This sensor works in the proposed system as follows

- As soon as the driver gets into the car or gets drunk while driving, the sensor which attached to the steering wheel (Figure 9) will detect the alcohol consumption limit of the drivers' breath. Likewise, the sensor would detect the alcohol limit in drivers' breath every 0.1 seconds.

Kindly note since this is an experiment, I have used the maximum alcohol limit of 400. When using in a real system the maximum limit would be 0.8mg/L.
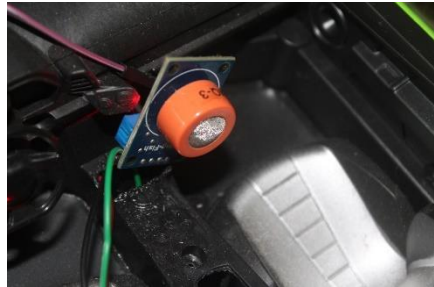
Figure 9. Ethanol Sensor attached in the proposed system

4.1.3. Bluetooth HC-05 Module

In this system, the Bluetooth module (HC-05 Bluetooth Module User Manual V1.0 (No. 16). (2018)) works in 3.3V power.

- In this system, the Bluetooth requests emergency contacts as soon as the system detects the driver is drunk.

4.1.4. SIM800l GSM GPRS Module

SIM800L GSM GPRS Module allows for the receiving of text messages saying, 'The Drive is Drunk' and voice calls as well as the current location of the vehicle. This module indicates yellow light for the connection and blue light for the GPS connection.

4.1.5. LCD to I2C

LCD to I2C is being used due to the opportunity it can directly be connected to the Arduino.

This component used in the system to Displays the alcohol limit of the driver's breath in the LCD.

4.2. App Design

This app has been used to increase the usability and reliability of the system by giving opportunity for the driver to add three more Emergency contact numbers to receive the message and a call with the driver's current location as soon as the system detects the drivers' Alcohol limit is high.

4.2.1. How the app and the circuit has been connected?

The circuit will request for an emergency contact number if it detects an alcohol level over the threshold. The app will send the requested contact that is already added by the driver in his/her signup process.

4.2.2. Guideline for the App

The procedure of connecting the app with the circuit will be differs in situations as follows.

1. If the driver registering for the first time

- If the driver registering for the first time Driver has to click the Driver button in the home page
- Then click the signup button
- Add drivers details in all required blanks
- Then driver get to add his/her three emergency contact numbers
- After the driver submit it driver can connect the app with the circuit via Bluetooth by clicking the connection on Home and connect on the Connect page

2. If the driver already has an account

- Click the driver in the home and it'll direct to sign up and login page
- Then click the login button in that
- After that his/her registered phone number
- Thus, the driver would be able to connect the app with the circuit in the same procedure as mentioned in Sign Up Method

Note that without Login to the app driver would not be able to connect the app with the circuit.
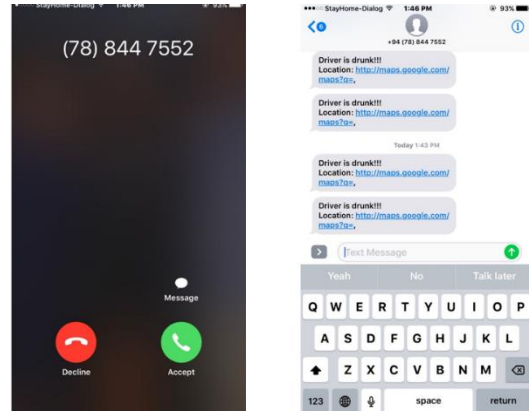
Figure 11. Emergency contacts receive a call and a text message with the vehicle's current location

5. CONCLUSION

The outcome of this project has been aimed to build a reliable, reusable and user-friendly, and innovative system that would prevent drivers from driving the vehicle under high alcohol consumption levels. Moreover, this paper has focused on building an innovative system that would help to increase economic growth by mitigating the number of accidents and losses that happen due to Intoxicated driving.

Moreover, this reusable system that prevents drivers from drink driving would mitigate the number of accidents and damages.

Finally, the Emergency Alcohol Consumption Limit Detector detecting the drivers' breath every 0.1 seconds will give more accurate and reliable results. That is why this proposed system is can be identified as the innovative solution for all the drawbacks shown in the existing systems and also as a system that helps for economic growth.

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Comparison of Covid 19 Pandemic in Sri Lanka with Global Disease Outbreaks

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ABSTRACT

In the modern pandemic situation, the outbreak of such infirmity is highly prominent. This research mainly focuses on the comparison of various health catastrophic effects to Sri Lanka in the recent past. It has included the Covid-19 disaster as well. Firstly, the epidemics had drastically escalated from the 17 centuries onwards. Hence, it is more appropriate to observe the demeanor of such incidents to obtain a commendable outcome to face any pandemic ambiguity. The Plague is the initial catastrophe faced by the country of France in 1720. Thereafter, the Cholera pandemic has activated in 1820 and affected the Asian and European regions. The Spanish flu has become the most vulnerable hazard in 1920 and costs more than 100 million souls on the earth. The current Covid -19 pandemic has severely impaired the livelihood of the whole nature and toll by 3,548,628 deaths on the date of 01st June 2021. As per the world health organization, pneumonia of unknown cause was detected in Wuhan China on 31 December 2019.

In different circumstances, there is an affiliation with the duration and effectiveness of aforesaid pandemic natures. This study will illustrate the association of such a malady to assure future response and readiness.

In addition, the Statistical Package for the Social Sciences has been used to obtain the response of collected data to result in meaningful determination. This outcome shows the connection of pandemics with affected ratios.

In conclusion, the most effective results have been identified by using the aforesaid different types of analytical methods and recommendations displayed appropriately. Finally, the study has pledged the wave achievement in the closure of pandemics.

Keywords: Pandemic, Plague, Cholera, Spanish flu, Covid -19, Statistical Package for the Social Sciences

1. INTRODUCTION

The pandemic outbreak has severe extraordinary history when considering the plethora of literature in the past eras. In order to observe the pattern and data are immensely benefited for the relevant authorities which produce the results. Furthermore, this will assist in the mitigation process of such extermination which happened since ancient.

This research focuses on finding the correlation of the pandemic outbreaks of the world and Sri Lanka by using a quantitative approach.
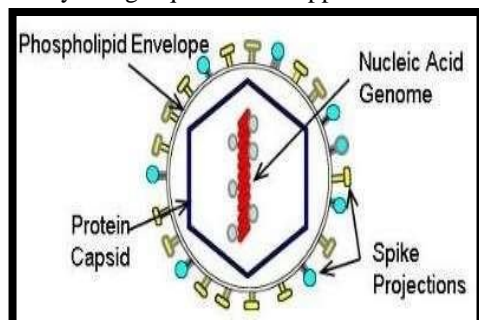

Figure 1. Virus Structure

Source:(British society for Immunology,2020)

This research has been based on the consideration of the world's major outbreaks of a pandemic in the past hoary. Furthermore, these catastrophes can be categorized into four major eras. The recent affected virus enveloped information shown aforementioned Figure 1.

Another instance, the plague outbreak prevailed on numerous occasions in France (Devaux, 2013). Secondly, cholera spread in France in the year 1892 can be elaborate (Pollitzer, 1954). Thirdly, the tragedy of Spanish fly has claimed the highest no of deaths in that 1920 era in the whole world (Johnson & Mueller, 2002).

Finally, the recent Covid-19 epidemic devastation has been taken into consideration in this study.

1.1. Problem statement

In modern health analysis systems, activities related to virus outbreaks are highly critical. However, calculation of such vulnerability has not been promptly utilized to accumulate the impact for society overall. The main complication needs to be addressed in this concern.

"Currently, there is no result of such pandemic statistical analysis has been finalized to cater the future aspiration of hardship"

The research question can be summarized as:

"What are the impacts of the population with death or infection rate of pandemics in the World and Sri Lanka?

Objective 1 - To identify the information and data related to the past and present pandemics in the world.

Objective 2 - To identify the impact which relates to the outbreaks of pandemic disruptions in the year 2021.

2. LITERATURE REVIEW

The objective of this literature review is to find out the characteristics of the pandemics which had severely suffered former times in the world. This research has based on by consideration of four major outbreaks of the pandemic in this hoary world. Furthermore, such catastrophes can be elaborated as follows.

Firstly, the plague outbreak prevailed on numerous occasions in Mediterranean harbors, including Marseille in the south of France (Devaux, 2013). It has claimed upward of 90,000 communities in the south of France (Greenwood, 1911).

The plague epidemic wave has shown in Table 2.1.

Table 2.1: The plague experience of the south of France in the year 1720 Source : (Greenwood, 1911)

Population group	No. of towns	Total population	Total deaths	Death rate
90,000	1 (Marseilles)	90,000	39,134	43·5
20,000—90,000	2	46,000	20,694	45·0
5000—	4	24,000	5457	22·7
3000—	7	25,200	4805	19·1
2000—	3	6200	1300	21·0
1000—	4	5050	1242	24·6
500—	10	7224	1904	26·4
0—	7	2175	493	22·7

Secondly, the cholera pandemic had been spread in the year 1892 in France (Pollitzer, 1954). Most of the cities had been infected such as Hamburg and suburbs, Altona, Wandsbeck, etc., The details are shown in Table 2.2 as follows.

Table 2.2: Cholera spread in the year 1892 at France Source : (Pollitzer, 1954)

Locality	Number of inhabitants	Number of cases	Cases per mille	Number of deaths	Deaths per mille
Hamburg and suburbs	579,904	19,891	34.3	7,582	13.0
Altona	143,249	572	3.9	328	2.3
Wandsbeck	20,571	64	3.1	43	2.0

Tertiary, the Spanish flu had become the most critical and defenseless phenomenon in the year 1920 in most of the world regions. To study the circumstances of such an epidemic, the Asian region has been selected. The mortality of Spanish flu is shown in Table 2.3 as follows.

Table 2.3: Mortality of the Spanish flu influenza pandemic Asia in the year 1920

Location	Population	Published death toll (per 1,000)	Published death rate (per 1,000)	Recalculated death rate
Afghanistan		~320,000		
Ceylon (Sri Lanka)	5,109,000	91,600		17.9
China	472,000,000ᵃ	4,000,000– 9,500,000		8.4–20.1
India	305,693,000ᵇ	18,500,000		6.1
Indonesia	49,350,000	1,500,000		30.4
Japan	55,033,000	388,000	~6.70	7.0
Philippines	10,151,000	93,686	8.00	1.7
Taiwan	3,670,000	25,394		6.9
Southwest Asia		215,000– 430,000	5.00–10.00	
Other East and Southeast Asia		220,000– 1,300,000	5.00–30.60	
TOTAL		26,000,000– 36,000,000		

Source : (Johnson & Mueller, 2002)

Quadrant, the current Covid-19 epidemic has become an unmanageable tragedy for the recent world. Hence, the study heavily focused on the results of the aforementioned pandemic outbreak in Sri Lanka.

The population (WB, 2018) and statistics (Epidemiology Unit, Ministry of Health Sri Lanka) have been obtained by considering the date of 01st June 2021, and details are shown in Table 2.4.

Table 2.4: The Covid-19 pandemic disease outbreak in Sri Lanka of the year 2021

District	Population	FirstWave	SecondWave	ThirdWave	Total
1 Colombo	2251274	174	32123	16006	48303
2 Gampaha	2063684	51	18483	13673	32207
3 Kalutara	1060233	72	6966	12131	19169
4 Kandy	1279028	59	5710	4170	9939
5 Kurunegala	1462215	30	3191	6013	9234
6 Galle	990487	4	2645	4354	7003
7 Ratnapura	1015807	9	3654	3873	7536
8 Matara	761370	4	1544	2687	4235
9 Matale	441328	5	1214	2753	3972
10 Nuwara Eliya	703610	2	1259	2612	3873
11 Kegalle	785524	10	1770	1879	3659
12 Jaffna	738988	16	1441	1558	3015
13 Badulla	779983	4	1358	1565	2927
14 Puttalam	709677	39	1024	1611	2674
15 Anuradhapura	745693	31	820	1652	2503
16 Hambantota	526418	3	710	1611	2324
17 Trincomalee	359368	4	651	1526	2191
18 Moneragala	397375	6	545	1332	1883
19 Polonnaruwa	352934	10	475	1110	1595
20 Ampara	692897	9	498	927	1434
21 Batticaloa	330333	1	699	702	1402
22 Vavuniya	85428	2	623	377	1002
23 Mullaitivu	77183	6	276	660	838

3. METHODOLOGY

The research methodology was developed to estimate the deaths and infected persons in other countries and Sri Lanka.

The data has been obtained purely from the records of literature.

As a result of the literature review, section identifications, groupings, and relationships were made using these factors. The factors were measured using the SPSS analysis technique and it has successfully answered the question of: "What are the outbreaks of results in pandemics?" Figure 3.1 illustrates the research methodology.

Figure 3.1 Methodology

Based on the literature review, the theoretical framework illustrated in Figure 3.2 was developed. Two independent variables have been identified. Furthermore, one dependent variable was identified in this study. The relationship is represented by H1, H2 hypotheses.
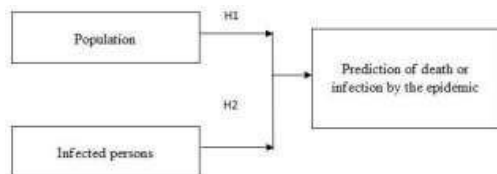

Figure 3.2. Theoretical Framework

A. Dependent Variable

The dependent variable was identified as death or infection by the epidemic in the outbreak of relevant pandemics.

B. Independent Variables

The independent variables were identified as population and infected persons in the epidemics. A change in these variables may cause a change in the dependent variable.

C. Hypothesis Development

To capture the relationship between the independent and dependent variables of the conceptual model, two hypotheses have been formulated for this study.

Let;

Ha- Alternate Hypothesis Ho- Null Hypothesis

The Ha (Alternate Hypothesis) is accepted for this research study and taken into the result of the research as we are researching the positive impact on the variable with the dependent factor. Furthermore, Ho (Null Hypothesis) is rejected from the hypothesis development as it is representing the negative impact of death or infection by the epidemic.

D. Hypothesis 1

1) Population: The population affected to the positive impact on death or infection by the epidemic.

Figure 3.3: Relationship between population and the dependent variable

H1a- Population of country and the death or infection by the epidemic are positively correlated

H1o- There is no correlation between the population of the country and the death or infection by the epidemic

E. Hypothesis 2

1) Infected persons: The definition of infected persons and the dependent variable are shown in Figure 3.4.

Figure 3.4: Relationship between infected persons and the dependent variable

H2a- Infected persons in the country and death or infection by the epidemic are positively correlated

H2o- There is no correlation between the infected persons in the country and death or infection by the epidemic

F. Research Instrumentation

The research was carried out using records of the pandemics in the world and Sri Lanka's history. Mainly such literature is used as a primer method of the research instrument

G. Data Collection

The quantitative approach was used to gather the primary data from known sources such as references of researches and acceptable and reliable sources of the internet.

H. Data Analysis tools used

The Statistical Package for the Social Sciences (SPSS) is widely used for statistical analysis in the research study. The graphical user interface of SPSS analysis presents a user-friendly environment.

MS Excel is a common, widely used, and reliable tool to record and analyses and graphical presentation those results.

4. DATA ANALYSIS

The main objective of the data analysis was to obtain the results of the relationships of factors selected for the theoretical framework to prepare

recommendations and the conclusion of the research thesis. The data were collected from a

SR.NO	LOCATION	POPULATION	DEATHS
1	MARSEILLES	90000	39134
2	TOWN 2	46000	20694
3	TOWN 3	24000	5457
4	TOWN 4	25200	4805
5	TOWN 5	6200	1300
6	TOWN 6	5050	1242
7	TOWN 7	7224	1904
8	TOWN 8	2175	493

research instrument and the SPSS tool was used for analyzing the data in the research analysis. Details of the analysis are given below.

The data analysis was carried out methodically to achieve the following objectives:

- Linear regression analysis to determine the result of the independent variable and dependent variable.

The formula is as follows.

Value = Constant value + Value * (Deaths) or Value = Constant value + Value * (Active cases)

The plague model of the year 1970 is shown in Table 4.1 as follows.

Table 4.1: The plague model summary (R-value) of the year 1720

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.985ª	.970	.965	2572.185	.970	192.989	1	6	.000

a. Predictors: (Constant), pop
b. Dependent Variable: death

The R-value has above the average of 0.5 and is positively correlated with the independent population variable and dependent deaths variable. The coefficient analysis is shown in Table 4.2.

Table 4.2: The plague coefficient analysis of the year 1720

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-2248.082	1236.027		-1.819	.119
	pop	.452	.033	.985	13.889	.000

a. Dependent Variable: death

The analysis of the outbreak of plague deaths in 1720 is shown in Table 4.3.

Table 4.3: The plague death analysis of the year 1720

The cholera spread model of the year 1892 is shown in Table 4.4 as follows.

Table 4.4: Cholera spread model summary in the year 1892 in France

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.984ª	.969	.938	1062.963	.969	31.315	1	1	.113

a. Predictors: (Constant), POPULATION
b. Dependent Variable: DEATH

The R-value has above the average of 0.5 and is positively correlated with the independent population variable and dependent deaths variable. The coefficient analysis is shown in Table 4.5.

Table 4.5: Cholera spread coefficient analysis in the year 1892 in France

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-895.856	802.245		-1.015	.495
	POPULATION	.014	.003	.984	5.596	.113

a. Dependent Variable: DEATH

The analysis of the outbreak of cholera deaths in 1892 is shown in Table 4.6.

Table 4.6: Cholera spread analysis in the year 1892 in France

SR.NO	LOCATION	POPULATION	DEATHS
1	HAMBURG AND SUB...	579904	7582
2	ALTONA	143249	328
3	WANDSBECK	20571	43

The Spanish flu influenza model of the year 1920 is shown in Table 4.7 as follows.

Table 4.7: The model summary of the Spanish flu influenza pandemic in Asia of the year 1920

The R-value has above the average of 0.5 and is positively correlated with the independent population variable and dependent deaths variable. The coefficient analysis is shown in Table 4.8.

Table 4.8: The coefficient analysis of the Spanish flu influenza pandemic in Asia of the year 1920

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	322011.719	2205372.832		.146	.890
	POPULATION	.031	.010	.802	3.005	.030

a. Dependent Variable: DEATH

The analysis of outbreaks in Spanish flu influenza deaths in 1920 is shown in Table 4.9.

Table 4.9: The analysis of the Spanish flu influenza pandemic in Asia of the year 1920

SR.NO	COUNTRY	POPULATION	DEATHS
1	CEYLON (SRI LANKA)	5109000	91600
2	CHINA	472000000	9500000
3	INDIA	305693000	18500000
4	INDONESIA	49350000	1500000
5	JAPAN	55033000	388000
6	PHILIPPINES	10151000	93686
7	TAIWAN	3670000	25394

The Covid-19 pandemic model has utilized data of 01st June 2021 and active cases are shown in Table 4.10 as follows.

Table 4.10: The active cases analysis model of Covid-19 pandemic disease outbreak in the Sri Lanka of the year 2021.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.755ª	.570	.557	7094.718	.570	29.998	2	44	.000

a. Predictors: (Constant), Total_covid19_cases, Population
b. Dependent Variable: Active_cases

The R-value has above the average of 0.5 and is positively correlated with the independent population variable and dependent deaths variable. The coefficient analysis is shown in Table 4.11.

Table 4.11: The active cases coefficient analysis of Covid-19 pandemic disease outbreak in the Sri Lanka of the year 2021

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.		Change
		B	Std. Error	Beta				
1	(Constant)	4427.586	4815.142		.920	.398		
	Total_covid19_cases	.256	.110	.661	2.331	.053		.000

a. Dependent Variable: Active_cases
b. Dependent Variable: DEATH

The analysis of the outbreak in Covid-19 pandemic disease in Sri Lanka for active cases is shown in Table 4.12.

Table 4.12: The active cases analysis of Covid-19 pandemic disease outbreak in Sri Lanka as of 01 June of the year 2021

SR.NO	DISTRICT	POPULATION	1-WAVE	2-WAVE	3-WAVE	TOTAL-INFECTED
1	Colombo	2251274	174	32123	16006	48303
2	Gampaha	2063684	51	18483	13673	32207
3	Kalutara	1066239	72	6986	12131	19189
4	Kandy	1279028	19	5710	4170	9899
5	Kurunagal	1460215	30	3191	6013	9234
6	Galle	990487	4	2645	4954	7603
7	Ratnapura	1015807	9	3654	3873	7536
8	Matara	761370	4	1544	2687	4235
9	Matale	441328	5	1214	2753	3972
10	Nuwara El	703610	2	1259	2612	3873
11	Kegalle	785524	10	1770	1879	3659
12	Jaffna	738888	16	1441	1558	3015
13	Badulla	779983	4	1358	1565	2927
14	Puttalam	709677	39	1024	1611	2674
15	Anuradha	745693	31	820	1652	2503
16	Hambanto	526414	3	710	1611	2324
17	Trincomal	255948	4	651	1526	2181
18	Monaraga	397375	6	545	1332	1883
19	Polonnaru	358984	10	475	1110	1595
20	Ampara	592997	9	498	927	1434
22	Batticaloa	330333	1	699	702	1402
23	Vavuniya	95428	2	623	377	1002
24	Mullaitivu	77189	0	278	560	838
25	Kilinochch	91764	0	250	598	848
26	Mannar	105235	0	379	171	550

Table 4.13: The correlation of Population and Total Infected persons in Sri Lankan as of 01 June of the year 2021

		Population	TotalInfected
Population	Pearson Correlation	1	.873**
	Sig. (2-tailed)		.000
	N	25	25
TotalInfected	Pearson Correlation	.873**	1
	Sig. (2-tailed)	.000	
	N	25	25

**. Correlation is significant at the 0.01 level (2-tailed).

A. Correlation Analysis

The main objective of the correlation analysis is to determine the relationship between the research variables. The first method is to determine the relationship of one variable with another. For this research, the relationship of one variable with another variable as well as the relationship of multiple variables with another variable was analyzed to determine correlations. The analysis shows a strong positive correlation with Total infected person via Population as 0.873.

Table 4.14: The Regression Analysis of Population and Total Infected persons in Sri Lankan as of 01 June of the year 2021

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.873a	.763	.752	5496.361

a. Predictors: (Constant), Population

B. Regression Analysis

The objective of the regression analysis is to analyze the linear relationship to obtain the analysis for the research study. The research analysis is based on the factors found in the literature. This research analyzed one factor with the other two factors and measured how these are influenced. The plague has the most productive value for regression linear analysis as per Table 4.15. Furthermore, the Covid- 19 values are also in the effective range of over 0.5 value as per Table 4.14 and Table 4.15. Therefore, Covid- 19 regression analysis is having immense importance over the mitigation of such an outbreak.

Table 4.15: Regression Analysis

Variable	R
Plague	0.985
Cholera	0.984
Spanish flu	0.802
Covid-19	0.873

5. CONCLUSION

The main objective of this research is to determine the analysis for the deaths or infected persons in pandemic outbreaks in the world and Sri Lanka.

As per the results which have shown in section 4, Table 4.3, Table 4.6, and Table 4.9 the analysis of population via deaths or infected have indicated.

The result has taken to analyze Sri Lanka is 01st June 2021. The total cases via active Covid-19 cases are shown in Table 4.12. Finally, the analysis shows the positive correlation with the Population and Total infected persons in Table 4.13 and Table 4.14

5.1 Recommendation

As per the above conclusion, It is recommended to practice and adhere to the guidelines which are indicated by the health services (WHO, 2019) to rebate the aforesaid infections on the community in Sri Lanka as well as the regions. Hence, it will be a hidden treasure to which everyone should comply with these instructions to extend the livelihood of our human beans.

5.2 Conclusion

In conclusion, the results of the research study provide important insights into the analysis to support the decision- making process of the relevant authorities. In addition, the case study is intended to give a comprehensive outlook on the pandemic outbreaks which might happen as catastrophes in near future.

5.3 Challenges & Limitations

There were a few challenges and limitations encountered in this research study.

- Difficulty in obtaining the literature resources because of the lengthy periods.
- The recent pandemic literature factors may vary day by day and need to finalize the exact accomplishment date for data gathering.

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Surface Urban Heat Island Formation in Colombo District: Strategic Solutions

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ABSTRACT

Climate change and unplanned urban development increase the temperatures of urban areas compared to rural areas. It is important to figure out which land use categories have made an impact on Surface Urban Heat Island (SUHI) formation. This is a major eco-environmental issue directly influencing people's health and wellbeing and most importantly, the city's energy use. Over the years, the temperature of urban areas in the Colombo district has increased. This study aims to observe the relationship between SUHI formation in the study area and the change in land cover from 2013 to 2020. The Landsat 8 OLI data are used to classify land cover and Landsat 8 TIRS data is used for surface heat profiling and classification using Urban Thermal Field Variance Index (UTFVI). Impervious Surfaces (IS) cover shows an increasing trend, water bodies show a decreasing trend, and bare lands show a fluctuation throughout the study period. The mean temperature in the Colombo district has increased from 24°C to 27°C from 2013 to 2020. The impact of changes on IS, Green Space 1 (GS_1), and Green Space 2 (GS_2) are correlated with the increase in Land Surface Temperature (LST). The increasing trend of IS cover is directly linked with the decreasing trend in the GS_1 and increasing trend of GS_2. The influence of the landscape components is important for SUHI formation. Therefore, findings from this study help the policymakers to take necessary actions for the health and wellbeing of the city dwellers to drive the country towards strategic solutions for sustainable development.

Keywords: Sustainable Development, Urban heat island, Land surface temperature, Landsat-8, Google Earth Engine (GEE).

1. INTRODUCTION

In 2015, the United Nations introduced 17 SDGs (Sustainable Development Goals) as an operational framework to protect the planet by 2030. The importance of urbanization is highlighted in Goal 11 "Sustainable cities and communities" of the SDGs. According to the World Health Organization, over 55% of the world's population lives in urban areas, a proportion that is expected to increase to 68% by 2050. One of the indicators representing different aspects of city conditions is the Surface Urban Heat Island (SUHI) formation, which has been investigated through airborne and satellite remote sensing over many years. The purpose of

this work is to show the potential of Google Earth Engine (GEE) to process free satellite Earth Observation (EO) Big Data for long-term and wide Spatio-temporal monitoring of SUHI formed as a result of urban surface temperature being higher than that of the suburbs (Li et al., 2015).

The SUHI decreases air quality and decreases water quality as warmer waters flow into area streams and stress ecosystems (Grimm et al., 2008). Due to the increase in temperature energy consumption also increases (Liu & Zhang, 2011). It has been shown that SUHI increases the human risk of violence and mortality (Patz et al., 2005).

We can use Geographic Information Systems (GIS) to detect thermal energy released from the earth's surface over a large spatial area precisely and cost-effectively. The GEE, which is a newly developed processing platform is used in this study to access wall-to-wall coverage of satellite data.

According to the Census of Population and Housing 2012, the highest number of household units have been recorded from the Western Province and Colombo city has a residential population of 558755 making Colombo the densest city in Sri Lanka. Colombo district has a population of 2,309,809. The recent findings reveal that the level of oxygen in Colombo city is not adequate for the population living in the city. This has triggered the policymakers to reform the development plans to make the city much greener in the recent past.

The goal of this study is to contribute to the body of knowledge on the SUHI formation occurring due to the shifting of the natural landscape from man-made structures from 2013 to 2020 in the Colombo district. The findings of this study will help to form a sustainable strategy for urban planning.

2. METHODOLOGY

2.1. Study area

Colombo District located in Western Province; Sri Lanka was selected. The study area's altitude varies from 1 to 30m above mean sea level with an area of 699 km². Colombo district is a mixture

of modern life, colonial buildings, and monuments. The Beira Lake situated in the heart of Colombo city is 65-hectare. The increase of population in this area has resulted in a considerable variation in Land Use Land Cover (LULC). Rapid urban developmental activities and annual variation of weather conditions in the district are motivations to select the study area. A unique geographic characteristic of the city is the coastal boundary which provides moisturized air.

2.2. Satellite data used and pre-processing

Satellite data was obtained from USGS earth explorer Landsat-8 Operational Land Imager (OLI) and Thermal Infrared Sensor (TIRS). By using GEE, LULC classification (Band 2-6) and the land surface temperature (Band 10) was estimated for 2013, 2017, and 2020. Firstly, all the imageries were chosen for the period and a cloud-free composite was created using GEE algorithms. GEE and a preparatory version of ArcGIS Pro 2.5.2 developed by Esri Inc. were used to post-process the satellite images.

2.3. Land use and land cover (LULC)

The LULC maps of the study area in 2013, 2017, and 2020 were classified using the GEE algorithm with the required labeling from the Landsat 8 imageries (Figure 1) using the supervised classification method. The land cover categories considered in the classification included: (1) Impervious Surface (IS); (2) Green Space 1 (GS1); (3) Green Space 2 (GS2); (4) Bare land; (5) Water. The GS1 includes forest and shrublands, while the GS2 includes grassland and cultivated land. To classify the IS surfaces, Normalized Built-up Index (NDBI), for the GS1 and GS2, Normalized Vegetation Index (NDVI), for the bare land Bare Soil Index (BSI), for the water Normalized Water Index (NDWI) were used.

LULC accuracy assessment was carried out by comparing with available reference datasets, which are assumed to be correct for defining a classification. Several methods were adopted to analyze users and overall accuracy of remote-sensed data (Abineh & Bogale 2015).
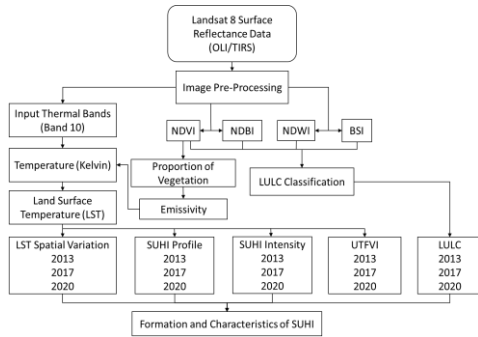
Figure 1. Methodology

The accuracy of change in LULC is influenced by factors like sensor component-associated issues and methods used for pre-processing of data with standard conditions at the time of image acquisition (Morisette & Khorram, 2000). In this study, the confusion matrix technique was used to compare post-classification.

Accuracy measures such as overall accuracy, user's accuracy, producer's accuracy (Congalton & Green, 2013), and Cohen's Kappa coefficient (Fleiss et al., 1969) were calculated in this study (Table 1). Cohen's Kappa coefficient shows an excellent agreement as it falls between 0.81 and 1.00 (Mather & Koch, 2010).

2.4. Land Surface Temperature (LST) analysis

Pre-processed datasets (Section 2.2) were used for the retrieval of LST, and analysis was performed using emissivity (ε) followed by emissivity corrected LST.

2.5. SUHI profiling

In this study, SUHI profiles were obtained from west to east, north to south, northwest to southeast, and northeast to southwest moving from left to right in the order of rural-urban-rural. Colombo city was chosen as the center for profiling the change of LST covering a distance of 397m between two points on the grid. Figure 5 illustrates graphs of mean LST obtained for the three years. Finally, by using the point values of mean LST for each year, a line graph of the multi-directional and multi-temporal SUHI profile was created (Figure 5).

Table 1. Error matrix of accuracy assessment of LULC classification.

LULC	2013		2017		2020	
	PA	UA	PA	UA	PA	UA
IS	96	98	99	68	85	99
GS1	95	100	92	97	99	99
GS2	81	9	65	40	85	81
Bare land	76	59	98	80	92	24
Water	100	100	100	100	99	100
Overall Accuracy	96		92		97	

2.6. Intensity measurement and characteristics of SUHI

The intensity of the SUHIs presented in Section 3 were measured using SUHII$_{IS-GS}$ and SUHII$_{U-R}$ (Estoque & Murayama, 2017). Furthermore, only IS, GS$_1$, and GS$_2$ influence LST significantly (Sun et al., 2012).

To calculate the fraction of IS and GS, the data acquired by the created fishnet was used. The count of GS surfaces started from urban areas to rural areas, while the count of IS surfaces was done in other direction.

2.7. LST normalizing, urban thermal field variance index (UTFVI)

UTFVI which shows strongly affected areas was calculated and divided into six levels by six different ecological evaluation indices (Liu & Zhang, 2011). Thresholds in the six UTFVI levels are shown in Table 2 (Liu & Zhang, 2011).

Table 2. Threshold values of UTFVI.

Urban heat island phenomenon	Urban thermal field variance index
None	<0
Weak	0.000–0.005
Middle	0.005–0.010
Strong	0.010–0.015
Stronger	0.015–0.020
Strongest	>0.020

3. RESULTS

3.1. LULC Classification

Based on the LULC changes from 2013 to 2020, It can be concluded that Forests and shrublands (GS1) decreased over time (Figure 2). The IS had shifted towards land from the coastal region.

In 2013, the IS in the study area accounted for 16.2% only, but in 2017 and 2020, its proportion has increased to 18.0% and 23.1%, respectively (Figure 3).
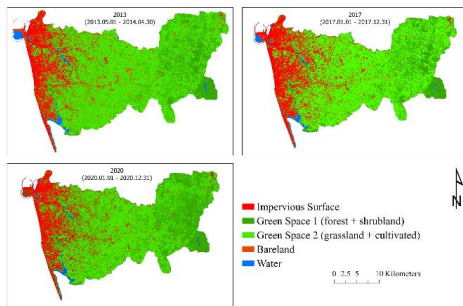

Figure 2. Land Use Land Cover of the Colombo district in 2013, 2017, and 2020.
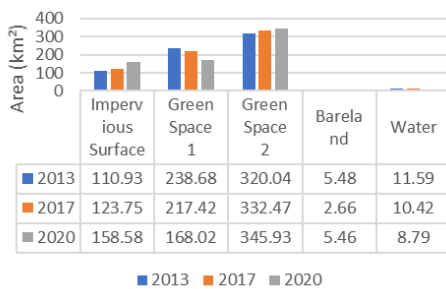

Figure 3. LULC change analysis in Colombo district during 2013,2017 and 2020.

3.2. Spatial Variation of the Land Surface Temperature

Eight LST categories were made to enhance the LST map's readability and to emphasize the spatial distribution pattern of the LST over the investigated period (Figure 4). In 2013, LST ranged from 12.8 °C to 31.4 °C, with an average of 24.0 °C. It varied between 18.8 °C and 32.5 °C, with an average of 26.1 °C in 2017. In 2020, it ranged from 18.7 °C to 37.0 °C, while the mean was 26.8 °C. This result showed a continuous increase in LST from 2013 to 2020 together with a special spread in the district. Therefore, further analysis needed to be carried out to find SUHI affected areas.

3.3. SUHI profiling

Along the grid, the mean LST had abruptly changed showing peaks near the urban areas and downs near the rural areas where the percentage of green space land cover is high (Figure 5).
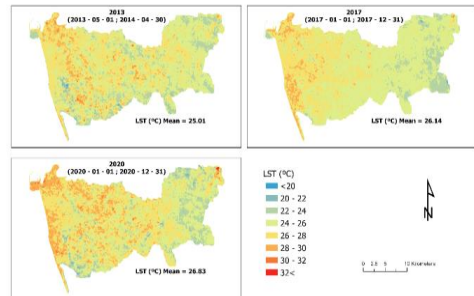

Figure 4. Spatial Variation of the Land Surface Temperature of the Colombo district in 2013, 2017, and 2020.

3.4. SUHI intensity measurement and characteristics

Temperature decreased from urban areas to rural areas in all three years and the moving average of the temperature increased over time (Figure 6 (a)). For a given year, IS decreased from urban to rural whereas GS increased from urban to rural as expected. However, for the period of concern, IS had increased and GS had decreased on average. It seems that the unplanned. urbanization had started to influence the rural areas of the Colombo district. The mean LST
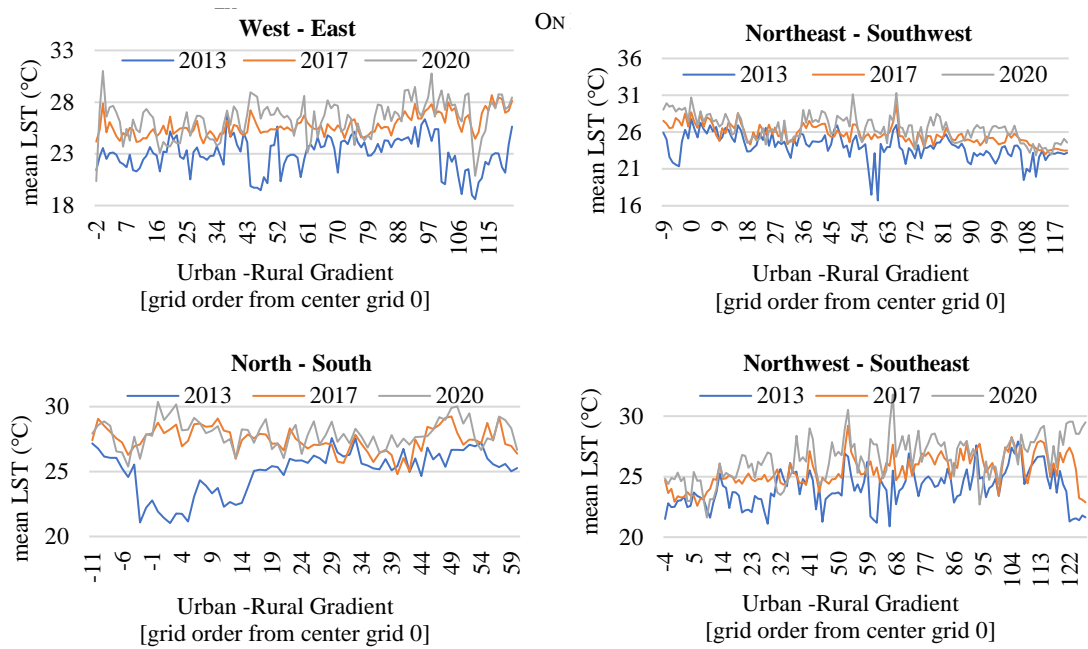
Figure 5. SUHI profiling of the Colombo district on 2013, 2017, and 2020 based on the mean LST
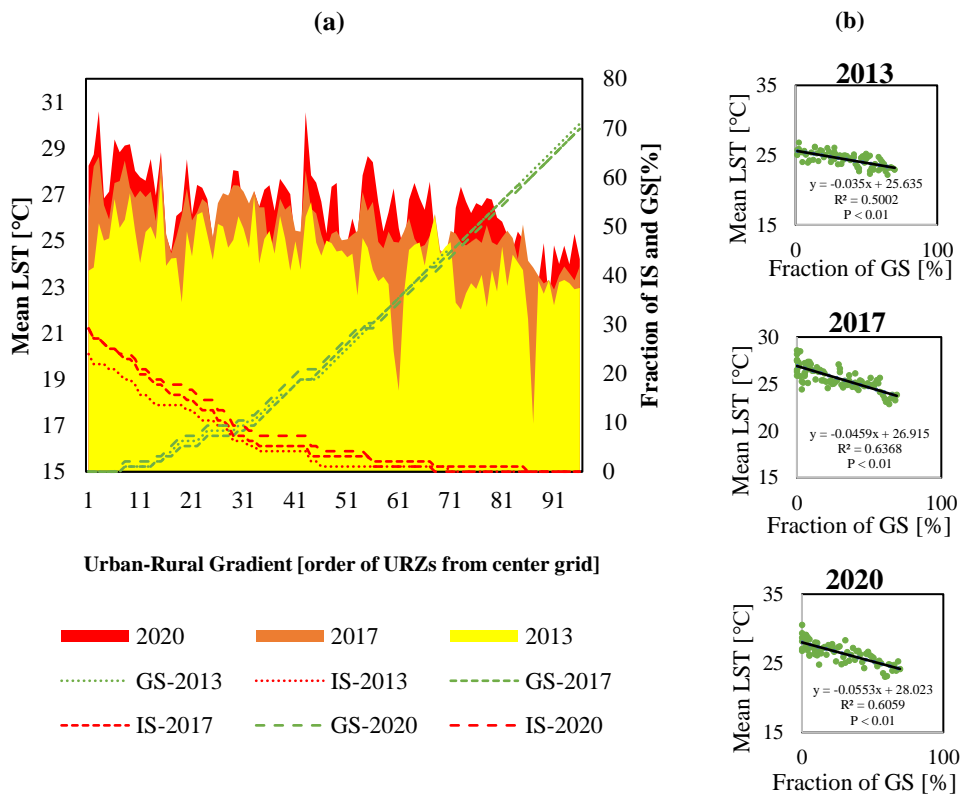

Figure 6. (a) SUHI profiling of the Colombo district (b) Regression analysis of GS and mean LST for 2013, 2017 and 2020

declined with the increase of GS fraction. Also, an increase in IS fraction caused the mean LST to increase. The linear correlation between GS and mean LST was significant ($p<0.01$) in all three years. Therefore, a linear regression was performed on mean LST considering GS as the explanatory variable separately for the three years (Figure 6 (b)). The regression lines showed a reduction of 0.035, 0.0459, and 0.0553 in mean LST for 2013, 2017, and 2020 respectively for a percent increase in GS. Therefore, the GS can be recommended as a solution for the increase in mean LST.

3.5. LST normalizing, obtaining urban thermal field variance index (UTFVI)

UTFVI was used to analyze the effect of SUHI further (Figure 7). The areas with the strongest SUHI effect had spread dramatically from 2013 to 2017, but from 2017 to 2020, the effect had got reversed. In the areas where most of the contractions started after 2013, SUHI became stronger than in other areas. Towards the right side of the Colombo district, the mean LST from 2017 makes the UTFVI classification categorized as the strongest SUHI affecting the area. This can be due to the expansion of the road system. In the city of Colombo, the effect of SUHI got stronger with time.
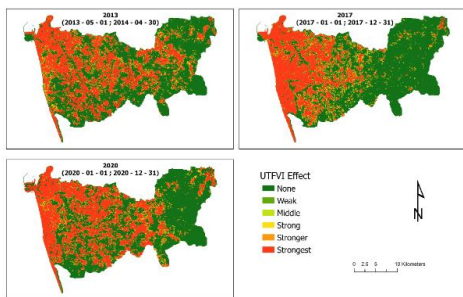

Figure 7. UTFVI in 2013, 2017, and 2020.

3.6. Evidence of intensifying SUHI effects

Table 3. Mean LST of IS and GS (°C)

Land cover	2013	2017	2020	Change
IS	25.34	26.83	28.50	3.16
GS1	23.00	24.17	25.00	2.00
GS2	24.07	25.54	26.21	2.14
GSᵃ	23.53	24.85	25.60	2.07

Table 3 illustrates an overall increase in SUHI Intensity (SUHII) in the study area between 2013 and 2020.

Table 4 illustrates how effective man-made cultivations such as parks and vegetation (GS_2) mitigate the effect of IS created by destroying natural forests and shrubbery lands (GS_1).

Table 4. Magnitude and trend of $SUHII_{IS-GS}$ (°C)

Land cover	2013	2017	2020	Average
	2.34	2.66	3.50	2.83
IS - GS₂	1.27	1.29	2.29	1.62
GS₂ - GS₁	1.06	1.37	1.21	1.21
IS - GSᵃ	1.81	1.98	2.90	2.23

*GSᵃ was taken from the GS1, and GS2 mean LST average.

4. DISCUSSION AND CONCLUSION

In this study, we investigated the changes in LULC, LST along with the formation of SUHI in the Colombo district. As the processing platform, GEE was used and the data was obtained from USGS Landsat-8 for 2013, 2017, and 2020. The analysis showed that the grassland and cultivated lands (GS2) increased while we witness the loss of forests and shrubland (GS1). This has happened mostly due to the increase of manmade parks and vegetation to compensate for the loss of forest and shrublands. Also, manmade infrastructure and buildings (IS) cover has increased due to the new development projects. The land surface temperature (LST) analysis showed an increase in the average temperature. There is an increase of 3.1°C in the surface temperature during this period in developmental activity zones while the overall increase in the Colombo district was found to be 2.8°C only.

Analysis showed that it is less warm if the land is covered with green space. Therefore, green space can be recommended as a sustainable strategy to mitigate the formation of warmer landscapes. The increased temperature affects the urban quality of life depriving the achievement of SDG 11 formulated for making cities inclusive, safe, resilient, and sustainable.

As future work, the impact of increased temperature can be investigated to see the

correlation with heat-related illnesses and fatalities (SDG 3), high consumption of energy for cooling (SDG 7), local weather and climate (SDG 13), warmer water bodies affecting life underwater (SDG 14) and ecosystem function on land (SDG 15). Therefore, it obstructs the achievement of sustainable development goals to protect the planet by 2030.

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A Diabetes Care System During a Pandemic Situation

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ABSTRACT

End of 2019 a new virus was found known as COVID-19. Due to this pandemic situation, it is very unsecure to meet up many people together at one place. It is a huge problem for the people to do their day today activities properly. "Background COVID-19 pneumonia is a newly recognized illness that is spreading rapidly around the world and causes many disability and deaths. Some diseases, for instance diabetes, is continuously suggested as a risk factor which contributes to the severity and mortality of COVID-19"(Abdi *et al.*, 2020). Hospital is a one of the places where people take huge risk due to this problem. So, to be sure about protectiveness about the diabetes patients in the hospital there should be a computerized system where patients can take their treatments by staying at home. Every treatment needs to be taken by visiting the hospital. But it is not good with the present situation and difficult to manage. So, we have developed a hospital management system where patients and doctors can communicate with each other in the best manner. This system is specially developed according to the situation most people face today. Visiting the hospital and taking medicine is very difficult these days. Because there is a huge queue to take medicine. And as well some patients do not have time to stay in the hospitals for a long time because of their busy work schedule and as well as the COVID 19. And some patients are not able to visit the doctor alone. In the proposed system the patient can take their treatment by staying at home. In this system, patients need to register first and can upload their reports to the system. Then after doctors can log in to the system and can give prescriptions to the patients according to their disease. After doctors prescribe medicines pharmacists can download it and deliver the medicines to the patents. Pharmacists can send messages to the patients via email. So, patients can take their medicines without any delay. By this system patients and doctors can chat with each other. So, they can have a better service and interaction between them. So, that the spreading diseases like COVID 19 can be minimized.

Keywords: Covid-19, Patients, Doctors, Pharmacist, Hospital

1. INTRODUCTION

"Diabetes is not caused by sugar, per se, but it has everything to do with how your body handles the sugar you consume and what you do to manage the level of sugar in your blood."

-*Sheryl Huggins Salomon* "One in five adults in Sri Lanka has either diabetes or pre‑diabetes and one‑third of those with diabetes are undiagnosed" (Katulanda, 29 August 2008). It seems diabetes patients can be categorized into many stages. "There are approximately 4 million diabetes patients in Sri Lanka" (life, 2016). This disease occurs due to the not enough production of the hormone insulin by the gland behind the stomach which is known as the pancreas or the not proper usage of insulin within the body. Sugar is carried through the bloodstream to cells with the help of insulin.

Some part of the sugar is converted into the energy and another part is stored as for the future. A dangerous condition can be occurred due to the high storage of sugar in the body cells. The sugar level should be carefully managed throughout the day.

Controlling glucose levels is very important because the uncontrolled glucose level can be increasing the risk of health conditions. "A primary obstacle is patient noncompliance concerning diet, exercise, and medication" (Helal, Cook, and Schmalz, 2009). Although there is a decisive need to regulate the blood glucose level.

Currently, there are so many methods to treat diabetes patients in Sri Lanka. But with the development of technology, there is no proper way to interact with the patients and doctors with the use of technology. Diabetes Booth (The doctors, patients, pharmacist interaction system) is a system that is going to introduce to solve the above problem. By this system doctors, patients and pharmacists can communicate without meeting them face to face. Patients can send their blood reports as an image and the doctor can read the report and conclude the glucose level of the patient and prescript the medicines to the patient. Then the doctor can send the prescription to the pharmacist and the pharmacist can deliver the medicines to the relevant patient. This project is done to patients who are checking their sugar level for the first time in the Uva province.

2. RESEARCH BACKGROUND

"Sri Lanka enjoys universal health cover provided mainly by a country-wide system of hospitals financed, staffed and equipped by the Government"(Pole, 2010). Many rural hospitals record their patient's details in the manual. The manual method of recording patient details makes heavy workload toward the staff of the hospital. And, manually recording data will affect too many difficulties. Sometimes the data can be misplaced, and the security of data is low. There is a long delay to access inpatient care because the hospital offers outpatient services also during the working

hours.

The current system of the urban hospital makes many difficulties for the patients. Sometimes patients need to spend their whole day to take medicines. So many patients are now rejecting to go to general hospitals to take their treatments. Sometimes they go to the hospital and come back because the doctors are not available. In the current system, there is no way to know the availability of the doctors.

"Improving primary health care for Sri Lanka's citizens requires focus, consensus, and sustained commitment to defined priorities" (Health and Medicine, 2017). So, with the development of technology new methods should introduce to the patients and doctors to keep interaction between them.
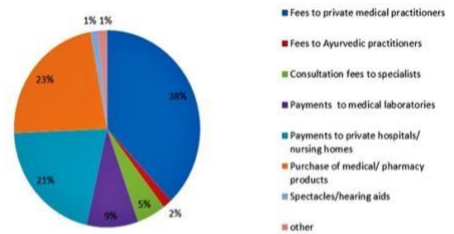
Figure 1 : health cost for the poor in Sri Lanka (daily news.lk)

2.1 What is it?

"Fueled by the epidemic proportions of lifestyle- related diseases, many players are seeking to design low-cost and tailored information and communication technology (ICT)-based systems for supporting lifestyle changes and disease management " (Tatara and Hartvigsen, 2010). The main aim to create a desktop-based application to create interaction between doctors, patients, and pharmacists. So, this provides a system that delivers a more intuitive and more efficient service to the user.

3. LITERATURE REVIEW

"The rapid growth in Information & Communication Technology (ICT), and the power of the Internet has strongly impacted

the business and service delivery models of today's global environment"(Balaraman and Kosalram, 2013). So, for the medical industry also new technology needs to be introduced. By computerizing these systems,

➢ Easily access to patient's data.
➢ Cost efficiency.
➢ Reduce the scope of errors.
➢ Increase data security and retrieve-ability.
➢ Improved patient care.
➢ improved data security.
➢ Better revenue management.

It can be identified as an advantage. So, we proposed a system with a fully computerized function to achieve these advantages. According to this system, patients can register in the system, but doctors and pharmacists are already registered in the system. After registering in the system patients can upload their blood reports to the system, so the doctor can examine those reports and assign medicines to the patients who are suffering from the disease. After assigning the medicines doctor can send those medicine prescriptions to the pharmacist to deliver the medicine. The doctor is sending the medicine prescription with the unique id of the patients so pharmacists can identify the relevant patient easily. Those are the main functions of this system. Without this type of system, we have to face "issues of quality, relevancy, and effectiveness as consequences of severely economic disruption" (Mousazadeh *et al.*, 2013). By producing this type of system, we can overcome the issues like this.

4. TECHNICAL RESEARCH

The user needs to visit the web to engage with this developed system. After accessing the web patients need to register in the system with a username and a password. It is essential to have an email address to each user because the pharmacist sends messages via email. The important thing is every user should have an internet connection to use this application. Every patients' details are saved in the database who are registered in the system. On the home page, the users can view all the available

doctors. The use-case diagram shown in Figure 2 describes the designed system.

Assume that the user needs to select an available doctor then the user can select a doctor from the doctor list before they select the doctor's patients can see the qualification of each doctor. And, when the user directly to the home page each patient can read some descriptions about the diabetes disease and get some knowledge about the disease. And each user can rate the system. When users rate the system the rating percentage is displayed in the system. And each user can see the details about the doctors.
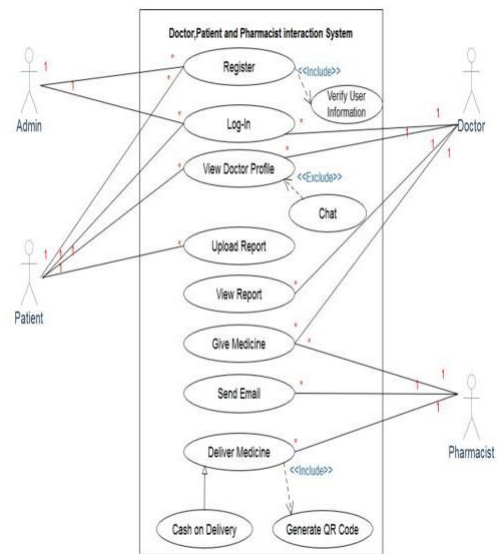
Figure 2: use case diagram.

So, the patients can select the best doctor to take their treatments. The patients can redirect to the page where the doctor's names can be displayed so, each patient can select the doctor. Then they will redirect to the page where user can upload their report to upload the reports the user needs to register in the system. Once the users register in the system the details of each user are recorded in the database. To register in the system each user should have an email address because the

system needs an email address to communicate with the patients. Once the user registered in the system the user can log in to the system. After logging in to the system the user can upload their blood report to the system. Once they upload the blood report to the doctor, they are redirecting to the home page.

The doctors are already registered in the system due to security reasons. The fake doctors also can be registered in the system if the system admin allows doctors to register in the system. To avoid that situation the doctors are already registered in the system. Once the doctors log in to the system, they can retrieve the reports which patients have uploaded. Then the doctors can examine those reports and assign the medicines to the patients who are suffering from disease diabetes. And send those prescriptions to the pharmacists. When the doctor assigning the medicines to the patients the doctors can chat with the patients if the doctor needs to get further details about the patients. So, there is a chat application that can be used to chat between the patients and the doctors. Once the prescription is sent to the pharmacists. pharmacists can deliver medicines to patients. To see the prescription of each patient, pharmacists need to log in to the system. After logging in to the system, the pharmacist can see the prescriptions of each patient with a unique ID. The pharmacist can send an Email and inform the patients about the delivery details.

5. SYSTEM ARCHITECTURE

"One of the most interesting, and most difficult, of the tasks that we may undertake in our careers as engineers or computer scientists is the design of an entire system.
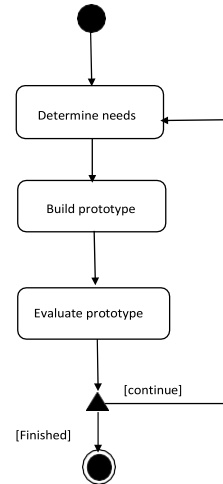

Figure 3: UI prototyping process diagram.

A system is a set of interacting parts, generally too large to be built by a single person, created for some particular purpose" ('On System Design', no date). This diabetes booth is specially created for patients who are taking medicines from hospitals in the Monaragala district. This proposed system has all the features which are in the computerized hospital system where we can upload the report and some extra unique features. This system mainly focused on the major problem which each patient is facing today. This proposed system was crated as only web applications.

6. FUTURE SCOPE

The developed system is currently limited to the patients within the Monaragala district. But with the future development we are planning to introduce this system to al over the country. As a result, the patients outside the Monaragala district also can register in the system and take their medicines online. To this patient can select their district and redirect to the page where it shows the name list of the doctors that are relevant to that district. So, the patient can select the doctor and upload their blood reports and the main pharmacy in that area also can be registered in the system by these patients can select their district and take their medicines easily.

And it is planning to create a payroll system where patients can pay for the medicine

online. By this, the medicine price list can be visible to the patients and patients can pay for them online. To create this type of application it is very hard with this project so, during the further implementations, we are trying to create that part also. So, this patient can pay for the medicine by using their credit card. And we are planning to create the same system with the Sinhala and Tamil language. So, patients are comfortable enough to use this. The most related problem that arises as a result of the interview is when creating this type of application is most of the patients who take general hospital treatments are literally low knowledge in information technology. So, introducing that type of service is not that much easy. By keeping some training programs patient should train to use these types of applications.

And when creating an SMS system, which is useful to send SMS alert to patients easily is difficult to create due to financial requirements. The SMS API also needs to take by paying for it so, the good financial supplement should be needed. As all the patients are using a mobile phone SMS alert service is a good method to introduce.

There are several limitations to QR code also. we proposed to create a QR to generate when patients are registering in the system. But to create a QR code the patient's literal knowledge is not enough. So, a created QR generation for the pharmacist to display the details about medicines and the relevant information. Above mentioned are the ultimate goals to reach in further developments.

7. CONCLUSION

The main purpose of this system is to save the time of the people who are in the Monaragala district and make their life easier in all-in-one interaction system. During this pandemic situation this system is based on true incidents which my family members also experienced in their life. There is no method to consult patients rather than the manual system. Then for that kind of situation, we innovate this product as the market winning product with a clear understanding of business needs and about the

future implementation of this project as a product. According to my knowledge, we think this product is successful among hospitals. Hence this product is the best product with awesome unique features the users would like to use them. Doctors, Patients, and Pharmacist Interaction System or the diabetes booth saves the time of all diabetes patients in the Monaragala district. Because of the user-friendliness and the other unique features one day this idea-based product will lead the market like never. As for the development of this system, we have used the main technologies such as asp.net C#, HTML, CSS, JavaScript.

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Loving-indness meditation: To Reduce Negative Emotions of Undergraduates

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ABSTRACT

A growing body of literature has identified a range of beneficial biological and psychological outcomes from the regular practice of loving-kindness meditation. For university students, Loving-kindness meditation is claimed to reduce negative emotions, distress, anxiety, fatigue, and enhance strength. The objective of this consolidative review was to critically appraise the literature that related to the effectiveness of loving-kindness meditation programs for undergraduates and other students who follow different academic courses at the university and was to look at whether LKM may be a compelling mediation to advance positive psychological wellness to diminish negative emotions such as sadness, anger, frustration, loneliness, etc. in university undergraduates.

This review was conducted using Whittemore and Knafl's framework (2005) for integrated reviews. Using the terms mindfulness, emotion reduction, meditation, Loving-kindness meditation(LKM), undergraduates and higher education a comprehensive search of the google scholar database. The initial search located 1250 articles. After screening and checking for eligibility 30 articles were critically appraised using qualitative papers and quantitative papers. The final number of papers included in the review was 17. The results of this review identified that loving-kindness meditation has a positive impact on undergraduates as well as university students' distress, negative emotions, depression, fatigue, sense of emotional well-being, and compassion. However, most of the papers described small-scale localized studies which limit generalizability. The complicated and exacting nature of present higher education emphasizes the necessity for techniques like LKM that has the potential to make resilience and enhance university students 'well-being. There is a possibility to advocate LKM systems involving mind and body relaxation to be introduced to the educational program for university students within the first year of every academic course. It helps to regular students' negative emotions and distress. . Further studies focusing on many research articles of the world would be useful in extending this effort.

Key words - Mindfulness, Emotion Reduction, Meditation, Wellbeing, Loving-kindness meditation (LKM), Undergraduates, Higher education

1. INTRODUCTION

Loving-kindness and compassion are integral to the human practice and within the learning process. The purpose of this study was to review the chance factors that youth understanding related to disconnection by exploring however the mixing of Loving-kindness meditation, otherwise referred to as *Metta* meditation, cultivates a way of affection as interbeing among undergraduates and youth in university environments to supply mind relaxation techniques in support of youth development.

Up to now, attentiveness or mind-based practice has received a lot of interest within

the meditation analysis community. Over the last decade, the standard of attentiveness analysis has more and more improved, and coaching programs became additionally standardized, resulting in additional strong and consistent findings (Northwood, M et al 2018). A consequence of this method is that the inclusion of mindfulness-based techniques into possible improvements in concentration (Chin, L. C., et. Al, 2020). Studies showing positive effects of attentiveness meditation on health and well-being made up the means for kindness-based meditation (KBM) to be investigated.

Individuals' everyday encounters of even gentle positive feelings hold esteem as assets in the substance of life's requests. Experimental proof has shown that positive feelings can "fix" the waiting cardiovascular delayed consequences of unhappy emotion harms spectators' behavioral intention (Foroughi, B., Shah, 2019) and what's more, fuel versatility to affliction (Galatzer-Levy et al, 2018). Free of changes in bad feelings, everyday positive feelings have been connected to decreases in burdensome indications (Theodoratos, M., et. al,2020) and reduction from a significant burdensome issue (Berenbaum, Howard, et al.,2021).

Given the potential impact of LKM for undergraduates, critical analysis of the latest literature on this subject is guaranteed. Therefore, this paper presents an integrative review of the literature that examined the effectiveness of LKM programs for university undergraduates.

2. BACKGROUND

Meditation is identified as a tool for developing heedfulness. Heedfulness refers to engagement in or curiosity concerning the current moment, which inspires the associate degree perspective of non-judgmental openness and acceptance, to cultivate calm and self-control(Bhandarkar, M. K. K. 2021). There are different types of meditation, for example, transcendental meditation (Mahone, M. C et al,2018), Tibetan meditation, Zen Mindfulness-Based Stress Reduction (MBSR) (Husgafvel, V.,2018),

Samatha (Pali), and mindfulness meditation(MM), sometimes referred to as *Vipassana* (Pali) (Depraz, N. et al,2019).

Several kinds of literature deal with the elimination of the mental problems associated with the anger character by practicing loving-kindness meditation (Metta bhāvanā) which is a division of Samatha meditation(Surya, B, et al, 2020). The application of Vipassana springs from the oriental culture of Buddhist meditation. The word Vipassana has been interpreted to mean insight that encourages the raising of judgment-less, moment-to-moment awareness each throughout the formal meditation apply and in daily life (Zhang, K.,2018).

Usually, meditation has been an inner and mending practice in certain parts of the world for over 5,000 years (Leal-Galicia, P. et al (2018). Customary meditation practices held some sort of otherworldly development, education, individual change, or supernatural experience as their definitive objective (Lester, E. G et al (2018)). Be that as it may, during the most recent 40 years, the act of meditation, both profound and mainstream, has become progressively famous and has been adjusted to the particular interests and direction of Western culture as a reciprocal and elective system to address an assortment of issues in medical services, business, and training (Van Gordon, et al, 2017).

The main objective of meditation is a condition of disconnected perception where experts become mindful of their current circumstance however don't become engaged with contemplating it nor do they respond to awareness or analysis of one's learning or thinking processes. A wide range of meditation practices depend on the idea of self-perception of prompt mystic movement, preparing one's degree of mindfulness, and developing a mentality of tolerating the course of an occasion as opposed to the content of it (Darshana, J. D.,2021). Further, meditation practices might be ordered as per certain phenomenological qualities: a) the essential

objective of training (i.e., healing or thoughtful), b) the course of the consideration (e. g., care, concentrative, and practices that shift between the field or foundation discernment and experience and an item inside the field), c) the sort of anchor or establishing utilized (e.g., a word, breath, sound, item, or sensation), and d) the stance utilized (unmoving sitting or moving; Lim, T. S.,2019).

Buddhist-inferred meditation rehearses are progressively being utilized in the treatment of psychological disorders. All through the most recent twenty years, clinical interest has dominatingly centered around mindfulness meditation, and explicit care interventional approaches are progressively being upheld or potentially utilized in the treatment of mental issues (it's just plain obvious, for instance, American Psychiatric Association (Silver, K. E., & Levant, R. F. (2019)) and National Institute for Health and Clinical Excellence (NICE) (Santonastaso, O,2020) practice rules for the treatment of psychological disorders).

In any case, over the most recent 10 years, there has additionally been a development of interest in the clinical utility of other Buddhist mediative methods (Surmitis, K. A., Fox, J., & Gutierrez, D. (2018)). Of specific importance is new involvement that incorporates meditative methods known as loving-kindness meditation (LKM) or *metta-Bhavana* in the Pali language and compassion meditation (CM). Investigations of LKM and CM mediations have exhibited a wide scope of psychological disorder-related helpful results that remember upgrades for the accompanying (for instance): (i) schizophrenia symptomatology (Sabaroedin, K, et al 2019).);

(ii) positive and negative affect (Akram, W., & Kumar, R.,2017); (iii) depression, anxiety, and stress (Van Gordon, W, et al 2017).); (iv) anger regulation (Song, J.et al,2020); (v) personal resources (Laguna, M, et al (2017)); (vi) the accuracy and encoding of social-relevant stimuli (Van Gordon, 2017).); and (vii)

affective processing (Leung, M. K. et al (2018).

CM is portrayed in the mind-based literature as the concentrative advancement of emotional sympathy as a component of the instinctive sharing of others' mental pain (Luberto, C. M et al,2018). LKM is more vigilant about the meditative approach of a sensation of love for all living things(Lusnig, L. et al,2021). Controlling internal feelings and observant emotions while not passing judgment helps educators begin to "flow with" their regular stressors, which successively will result in increased edges, as well as students experiencing less distress (Buchanan, T. K.,2017). Significant brain development takes place throughout adolescence (Yuan, J. P, et al 2020), which suggests that meditation practices would have a positive impact throughout this biological process stage. Additionally, studies have recommended that each educator and students benefit from aware approaches in terms of gaining a way of well-being and fostering positive relationships (Becker et al., 2017; Britton et al., 2014; Viafora et al., 2015). Given the often emotional and covid-19 pandemic effect on university functioning in contemporary academic settings (Agasisti, T., & Soncin, M.,2021)) and the reported erosion resulting from burnout(Glerean et al., 2017), an exploration of the potential benefits of LKM for undergraduates and other students at the university is guaranteed.

3. THE REVIEW

3.1. **Aim**

This consolidative review of the literature aimed to investigate the effectiveness of LKM programs for undergraduates and other students at the University.

3.2. **Design**

The review was conducted using Whittemore and Knafl's (2005) framework for integrated reviews (Northwood, M., et al 2018). This approach was chosen because it permits for review and critique of each quantitative and qualitative analysis paper, thus providing a broad review of the topic of interest (Kherwa,

P., & Bansal, P.,2020).

3.3. Search Methods

Databases were searched in January 2017 to know key research articles of google scholar that investigated the effectiveness of LKM programs for undergraduates and any other students at the university. An exploration of various research articles was taken on using mixtures of the following terms: 'mindfulness', 'mindfulness- based-emotion reduction', *'Samatha '*,'meditation', 'Loving-kindness Meditation (LKM)','undergraduates', university education. Hand investigating of reference list of integrated studies was also conducted.

The first search resulted in 1250 articles. Three additional records were identified through other sources and 696 replicas were removed. The remaining 557 papers were selected for relevance by the first author (PV) based on the insertion criteria. The outcomes of this stage of the method were then mentioned with the other authors. After review of titles and abstracts for suitability 425 were ignored, keeping 189 full-text articles to be assessed. One hundred forty-nine did not match inclusion criteria and the leftover 30 were then critically assessed. Thirteen final articles were eliminated following critical evaluation keeping 17 articles for inclusion in the review [shows in Fig. 1 – PRISMA].
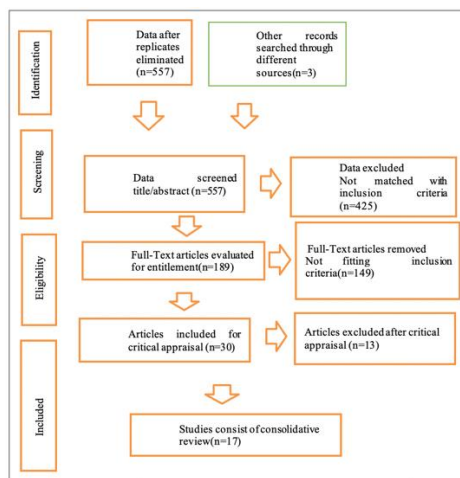

Figure 1. PRISMA Flowchart of Study selection

4. IMPROVING EMOTIONAL WELLBEING

Four of the studies (Lindsay, E. K et. al, 2018; Fredrickson, B. L, et al, 2017; Shahar, B et al,2015; Don, B. P et al, 2021) utilized Mindfulness-Based intervention revealed positive outcomes of emotional wellbeing. These results revealed a significant increase in participants' emotional wellbeing, social wellbeing, positive emotions.

The study of 'How mindfulness training promotes positive emotions.'(Lindsay, E. K et. al, 2018) provide the first experimental evidence that acceptance training is a key component of mindfulness interventions for increasing positive affect in daily life. Together, these studies emphasize the importance of learning to accept present-moment experiences for enhancing happiness and suggest that mindfulness interventions may be tailored toward boosting positive emotions and their associated benefits. (Lindsay, E. K et. al, 2018). A study of 'Positive emotion correlates of meditation practice' (Fredrickson, B. L, et al, 2017) empathies that meditation might influence daily positive emotions, that theory suggests might take issue between mindfulness meditation and LKM. The mindfulness-to-meaning theory (Hanley, A. W et al, 2021), as an example, suggests that mindfulness meditation improves emotional well-being through the intra-individual psychological processes of decentering and positive reassessment. In contrast, a recent extension of the broaden-and-build theory of positive emotions unpacks the advanced impulse expertise of affection (Oravecz, Z et al, 2020) and suggests that LKM improves emotional well-being through the social psychological processes of other-focus and quality resonance between and among people. A study on 'loving-kindness meditation program for self-criticism' (Shahar, B et al,2015) revealed that LKM will facilitate self-effacing people decrease self-critical and more self-

compassionate. Additionally, the results of this study recommend that LKM is also effective in reducing depressive symptoms and increasing positive emotions. Two randomized interventions studies based on meditation studies (Don, B. P et al, 2021) demonstrated that attentiveness meditation predicts sustained frequency and period of physical activity and will increase positive emotions throughout physical activity.

5. ADVANCING MINDFULNESS

Four studies (Teresa K. Buchanan, 2017; Kropp, A., & Sedlmeier, P. 2019; Polizzi, C. P. et al,2019; Allen, J. G,2021) found that utilized Mindfulness-Based intervention revealed positive outcomes of emotional wellbeing. These results showed a significant increase in participants' emotional wellbeing, social wellbeing, positive emotions. It is attainable to mention that one meditative practice, be it mindfulness-based or positive emotional-based, can enhance basic cognitive process skills. a positive emotional-based meditation is used as an effective tool to provide a direct result within the emotional modulation(Valim, C. P et al, 2019). Loving-kindness meditation showed higher impact ranges in concentration than the breathing meditation group, furthermore specific meditation techniques could have effects apart from expected psychological variables (Kropp, A., & Sedlmeier, P.,2019). Another study (Liu, C et al, 2020) disclosed that LKM evoked a big increase in spirituality and SWB. This result processed the psychological effects of LKM and recommended a break of clinical use.

6. ENHANCING MENTAL WELLBEING & COMPASSION

Four of the studies' (Kirby, J. N et al, 2017; Rao, N., & Kemper, K. J,2017; Liu, C et al, 2020; Poots, A., & Cassidy, T. 2020) results indicate that compassion-based interventions

hold promise as a kind of intervention to assist cultivate each compassion and self-compassion, decrease suffering (specifically depression, anxiety, and psychological distress), in addition as increase well-being(Keyte, R et al, 2021). In addition, a mindfulness-related practice to increase resilience to stress in undergraduates and interventions to foster mental well-being placed in settings such as academies(Galante, J. et al, 2018) and loving-kindness meditation improve mental health in undergraduates (Totzeck, C. et al,2020) and *Metta* meditation or LKM can facilitate therapy by raising more adaptive self-images, social connectedness, and emotional experiences (Stefan, S. I., & Hofmann, S. G., 2019).

7. PROGRESSING SELF-COMPASSION & EMPATHY

Five of the studies (Engel, Y et. al, 2021; Rao, N., & Kemper, K. J.,2017; Giovannoni, J.,2017; Gates, T.G et al, 2021; Bluth, K., & Eisenlohr- Moul, T. A.,2017) indicated that practicing self-compassion and mindfulness has facilitated caring moments and positive relationships with clients and colleagues as well as decreasing stress while increasing resilience. Furthermore, researchers have insisted that the development of empathy and compassion can have a positive impact on the relationship between students and teachers (Csaszar, I. E, et al, 2018). Additionally positive effects of teachers' attentiveness on their self-interest (assessed either with neurologic, cognitive, or self-report tools), on their emotion- regulation, fellow feeling and compassion toward students (as expressed by academics and students), and therefore the expected positive associations of these capacities with consequent quality of teachers' relationships with students and teachers' well-being and work effectiveness, and students' well-being and social and educational development. (Lavy, S., & Berkovich-Ohana, A. ,2020).

8. DISCUSSION

In studies covering more than five years, the numerous benefits of LKM have been revealed (Mantzios, M. et al,2021). This integrative literature review sought to examine the effectiveness of LKM specifically undergraduates and students in an educational institute. In general, the results of the review discovered that engagement in LKM programs, particularly once in the course of regular use, incorporates an important impact on emotional well-being, mindfulness, mental wellbeing & compassion, and self-compassion and empathy. These results are relevant both to the working lives of undergraduates and the academic engagements of other university students.

Several previous studies have found that many university students experience multiple sources of academic works stress and emotional issues, often (Willis, R. et al,2020). High levels of stress, negative emotional and depressive mentality can diminish the academic involvement that university students derive from their study and the achievement of academic works they engage in daily life (Kryza-Lacombe et al,2019).

Collective with low levels of self-compassion, stress, and mental wellbeing can also contribute to university students' emotional exhaustion and burnout (Cazolari, P. G et al,2020). Several studies have also found that university students frequently experience high levels of stress and emotional issues during their undergraduate studies, particularly when undertaking practical placements (Hurley, J,2020) and that these feelings can negatively impact their daily circumstances, well-being, learning, performance(Khater et al., 2014), and academic growth.

While complete eradication of negative emotions and emotional-related issues is not possible, enhancing the capacity for emotional regulation may improve undergraduates' and other university students' emotional well-being and ability to maintain satisfying social relationships with their associates and better academic standards. LKM has demonstrated to be a protective strategy that builds emotional regulation, leading to enhanced emotional wellbeing and self-compassion, and reduced negative emotions, and depressive mental status (Kılıç, A. et al., 2021) Learning and practicing LKM has the potential to develop important skills sets that could serve undergraduates and other university students well, both during their studies and around their professional careers.

8.1. **Limitations**

The relatively small sample sizes in each of the included studies limit the generalizability and representativeness of the results. Additionally, the requirement for independent LKM practice which could not be mandated or monitored may also be a limitation. Lastly, the review mostly included studies published in western countries; this may have missed other relevant and important studies, particularly those from Asian countries where LKM is very often practiced.

9. CONCLUSION

The complex and demanding nature of present higher education emphasizes the need for tactics such as LKM that have the potential to build resilience and enhance university students' well-being. We recommend LKM systems involving mind and body relaxation and meditation be introduced early in the academic program for university students in the first year of each academic course.

This review found that the implementation of LKM programs is each realizable and worthy, even inside limited resources. However, though the results recommend that LKM could have many useful outcomes for undergraduates and other university students, additional research is predicted. It hopes that the outcomes from this review can give the motivation for broader utilization of this comparatively efficient approach supported by a rigorous body of each qualitative and qualitative research. in addition, research exploring the impact of LKM practices on undergraduates' competence to produce academic discipline and self-compassion would conjointly build a valuable

contribution to the literature.

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Data Science for Economic Development: A Sustainable Strategy

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ABSTRACT

Sustainable development has been in use for over three decades but with the establishment of the UN SDG 2030 goals in 2015, it has a renewed focus to understand the joint responsibility of all stakeholders towards the future of sustainable growth. The paper places emphasis on Education (Goal 4) and the use of Industry, Innovation, and Infrastructure (Goal 9) for the sustainable growth of education. Data-driven decision making plays a major role in this regard. As Higher Education Institutes (HEIs) in the modern era strive to build resilience and develop innovation-led paths, the access to vast amounts of data at disposal has motivated HEIs to take data-driven decisions. Data science equipped with intelligent computational methods can produce advanced learning analytics for this purpose. More specifically, as HEIs become the backbone of many countries in producing future talent, much focus is placed on analysing educational data to identify what students want to learn and what content should be incorporated in an optimal curriculum. This is a contemporary review on sustainable development of education.

Keywords: Sustainability, Sustainable Strategy, Sustainable Development, Data Science, Economical Development

1. INTRODUCTION

Sustainable Development is defined as "development that meets the needs of the present while safeguarding Earth's life-support system, on which the welfare of current and future generations depends" (Griggs, David, et al., 2013). In recent times, UN Sustainability

Development Goals (SDGs) has become a key pillar for economic development in theory and practice (Mwitondi, Munyakazi and Gatsheni, 2020).

There is a need for prioritization on the certain goals as some nations do not have the financial capacity to meet the requirements to satisfy the agenda (Beeharry, 2021).

It has been shown that there is a significant correlation between the SDGs in its efforts (Sebestyénet al., 2019). Although these correlations mostly lead to positive results, in certain situations such synergies have led to negative correlations, tradeoffs and constraints (Pradhan et al., 2017). Hence, it is important to identify synergetic goals with a high positive and low negative impact on other goals' attainment when improved (Pincet, Okabe, & Pawelczyk, 2019).

Health (SDG 3) followed by Education (SDG 4) are found to be the most important in making a positive impact on sustainable growth. For that we need data-driven decisions.

We can use data science to produce learning analytics for monitoring development in education. Data science has been identified as a crucial new field of study which is a modification of classical disciplines such as statistics, databases and data mining which aims to not only extract data to explain the past but focuses on deriving new knowledge to make future decisions (Dhar, 2013; van der Aalst, 2016).

This is an attempt to see sustainable strategy to use technology, innovation and infrastructure to make learning analytics better.

2. METHODOLOGY

The study aims to integrate qualitative research techniques in gaining a deeper insight into the issue at hand. In exploring the ability to data visualize in identifying emerging themes, Nvivo is introduced as a key tool used in many qualitative research studies (O'Neill, Booth and Lamb, 2018). Nvivo is a popular tool in qualitative research which enables the categorization of rich data and helps to organize information effectively when compared to manual data compiling techniques (Alam, 2020). Despite Nvivo primarily being used as a software assisting qualitative research empirical data analyzing, some research has looked at its practical usage in conducting a literature review component of a research (Beekhuyzen, 2007).

The review was conducted by considering the concept of sustainability, identifying recurring themes, their key components and analysing how they interact with one another. The recurring themes are mentioned below. Several articles were excluded after the in-depth reading as they did not contain SDG goals.

With the use of Nvivo we have tried to explore the emerging themes in the literature. We looked at the recent literature published after the declaration of UN SDGs and the themes emerged with the Nvivo data visualization were data driven decision making, data driven decisions, data science, big data, and educational data. We also seek for the themes of higher education and quality education. We have looked for learning analytics and adaptive learning. We also looked at themes of economic developments with our

literature. Finally, we looked for the themes of use of technology.

This paper presents the results of the thematic analysis conducted using Nvivo on sustainable development of higher education.

3. RESULTS

3.1. SDG INTERACTIONS

SDGs consist of an expanding list of 231 unique indicators. More specifically, the SDG Index has been introduced to measure the progress of each country's performance on SDGs (Sachs et al., 2016). Using machine learning, the order of importance was shown to be SDG3, ''Good health and well-being'' (42%), SDG4, ''Quality education'' (24.8%), SDG7, ''Affordable and clean energy'' (8.6%), SDG9, ''Industry, Innovation and Infrastructure'' (5.1%) followed by other SDGs (Asadikia et al., 2021). The countries with below average SDG index, SDG4 (34.33%) and SDG9 (8.96%) together covers 43%. This indicates that education supported by technology, innovation and infrastructure can make a significant impact on a nation's SDG index.

3.2. Data Driven Decision Making

Complex interactions among various stakeholders can be understood using data science. However, there exist technical issues such as governance, sharing and security of data.

3.3. Learning analytics for quality education

Quality education can be considered as the pathway for achieving sustainable lifestyles so that all countries pay attention to the environmental challenges of the world at large while adopting in accordance with their own priorities. Indicators measuring universal primary and secondary education, early childhood development and universal pre-primary education, equal success to technical/ vocational and higher education, relevant skills for decent work, gender equality and inclusion, Universal Youth Literacy, education for sustainable development and global citizenship

are some of the estimates one could use for building up sustainable strategies for education.

Policy and practices about education urgently requires analyzing educational data since advancing technology can reduce the usefulness of human skills. Hence, it is appropriate to conduct research on the relevance of educational practices currently used. Data science has paved the way to analyze multi-dimensional data on personal qualities to improve educational practices (Duckworth and Yeager, 2015). Moreover, learning analytics can be reported in such educational systems. Therefore, learners can visualize their knowledge, performance, and abilities (Epp and Bull 2015). The broad availability of useful knowledge derived through the collection and analysis of educational data has created an increasing trend in data-driven decision making to inform policy and practices in education.

Generally, a lot of resources are diverted to achieve common good via quality education by any country. These resources can be optimally used if the performance of students can be predicted. Decision makers in education do not have local, unbiased, and real-time up-to-date data they need. Educational data mining provides valuable information in this regard. Students need personalized feedback with adaptive learning. Use of AI-based practices, educational use of AI-generated data, educational human-AI interaction is some of the options available in order to use AI in higher education. Online learning facilitates education immensely in the pandemic situation and deep learning and machine learning algorithms can be used to develop processes in line with cognitive levels and learning styles suitable for students for successful utilization in future.

If a system can predict student's achievements to identify at-risk students in earlier stages, sustainable strategies for optimal use of resources can be formulated. Another option would be to determine factors affecting student's performance with real time reporting of student's results and transparent assessment so that precautionary action could be taken to avoid failures by making them understand their own strengths and weakness. It is also important to improve teaching processes to minimize failures and AI can provide dashboards of performance evaluations of students. AI can also create flexible efficient learning tools, implement adaptive learning techniques, drive increased student engagement, and integrate technology to learn interactively, via dialogues, automated question generation and learning analytics.

3.4. Learning technology and innovation for quality education

AI gives the ability to solve a problem with enough data, statistics, and computational power without the need to be intelligent in doing so (Floridi, 2019). Therefore, it needs to be presented as a utility which shows digital solutions for technology, innovations, and infrastructure development in education.

Cloud computing assisted teaching and education based on cloud computing are some of the applications that happened way back in 2011 (Yang et al., 2011). It refers to ''a sharing computing technology that provides accessible computing resources, including storage, computing control, and application, delivered by using the internet as service'' (Arpaci, 2016). It can be utilized to save a large amount of expenditure on physical infrastructure for education. Work from anywhere just with the need of the internet, freedom of working with any device we have, support all types of devices, no need for an in-house IT support team, many cost benefits, less power consumption makes cloud technology much cheaper.

Ercan (2010) suggested that cloud-based applications provided by service providers assist the universities in operating their information systems effectively because it can provide on-demand services with high reliability, scalability, and availability in distributed environments.

Valtonen et al (2020) has shown the challenges Information and Communication Technology (ICT) has introduced in designing learning environments in universities. Learning environments need to be redesigned in an innovative manner for effective use of modern technologies for students to learn with active participation and as a team of experts.

Pedagogical innovations include flipped classrooms, makerspaces, games, and gamification (Friedrich et al. 2020). Gubareva & and Lopes (2020) has identified mobile and analytic technologies as future pathways for innovative learning environments with artificial intelligence providing virtual assistants for learning.

HEIs have long collected large quantities of data. This is Big Data which can be used innovatively, using data engineering techniques and data warehouses to convert universities into 'smart universities' (Lane, & Finsel, 2014).

These big new data technologies can be plugged into institutions and processes to provide intelligence to influence their policies, structures, and marketization of higher education via data-driven decisions. Technology has the capacity to transform the spaces of the university, its temporal rhythms and social relations in ways that align the work of the university with the logics of capitalist markets.' (Komljenovic, & Robertson, 2016)

4. CONCLUSION

To make economic development sustainable, resources need to be optimally used. In this article, we focused on education because a higher percentage of resources are utilized in this area and technology is widely available to make necessary improvements.

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ICT Supported Intervention to Manage Stress Among Undergraduates

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ABSTRACT

Stress has become a part of university students' lives. Many studies have shown that stress is a severe issue that affects students' mental health, academic performance, and overall well-being. Stress can be beneficial to a certain extent, but high levels of stress result in adverse effects. Digital mental health intervention is a growing phenomenon that provides enormous possibilities for managing mental well-being. Thus, this study's primary purpose was to gather design requirements for an Information and Communication Technology (ICT) supported intervention for undergraduate stress management. The study also investigates stress levels, stressors, coping strategies, and digital mental health intervention awareness. The target population is comprised of state and non-state university students in Sri Lanka. A survey distributed via social media platforms is used to gather data. The collected data was analysed using different statistical methods to attain the set objectives. According to the responses, the majority of respondents experienced moderate levels of stress. The GPA target, projects, assignments, and deadlines were found to be the everyday stressors. Respondents frequently used music, social media, and videos to cope with stress. The study identified a significant relationship between the degree of discipline and stress levels. It is worth noting that most respondents were not familiar with digital stress interventions for stress management.

However, they were interested in using such interventions. Following the study's findings, BeFREE mobile application was designed, incorporating six-core features and essential non-functional requirements.

Keywords: Stress, Coping, Undergraduates, Sri Lanka, ICT, Mental health

1. INTRODUCTION

Stress is the most common psychological issue in society. People of all ages, from young children to adults, suffer from stress for various reasons. The causes of stress differ from person to person, and how stress affects an individual is also different. Young people can face external stressors related to school, relationships, family, and financial problems. In addition to external stressors, they all experience stress due to internal causes. Many people get stressed because they have ambitions and find it difficult to put them into action, and some get stressed because it is difficult for them to adapt to and face the reality of life (Control-Your-Stress-Manage-Your-Time, n.d.).

When it comes to academic stress, it can be described as the body's reaction to academic demands that surpass students' adaptive skills. An academic stressor happens when the internal and external pressure is above the coping capacity of an individual (Aafreen et al., 2018; Bhargava & Trivedi, 2018).

Academic stress is the single most significant health barrier to university students' academic

performance (Stress and Gender: 2011, n.d.). The stress causes include academic matters, examinations, assessments, and targets to be fulfilled by that student; university students need to fulfill graduate requirements (Othman et al., 2013). According to research conducted using 2500 randomly selected undergraduates from Sri Lankan public universities, it was found that 80% of the top ten undergraduates' stress factors are related to academic workload and examinations (Dananjaya Weerasinghe & Udana Fernando, 2018). However, stress levels can affect the academic performance of an undergraduate in a negative way. The heavy academic workload can generate tense and worried feelings, which can lead to stress if they last for a long time. There is an exponential growth in the usage of technology among the young generation, and they have very tight schedules with the workload of their daily lives. Therefore, this study aims to provide a solution using IT to help younger university students cope with their stress and achieve their academic and life goals.

1.1. Research Objectives

The key research question was to determine the design requirements of an ICT-supported intervention for undergraduate stress management. To answer the research question, three objectives were formed: to identify the perceived stress levels among university students along with the common factors that make them stressed; to identify the commonly used coping strategies among them; and to propose an ICT-based application that supports university students in managing their stress levels.

2. LITERATURE REVIEW

2.1. What is Stress and Types of Stress?

"Stress" refers to a circumstance that stresses out a person where physical and emotional discomfort is felt by that person, yet the scientific definition describes a condition where an environmental demand exceeds the natural regulatory capacity of an organism (Elkin, 2013). Stress can be caused by four primary factors: the environment, society, physiological factors, and one's own thoughts. Stress varies from person to person, whereas a stressful event can be a pleasant experience for others (Piperopoulos, 2019). Mainly, there are three types of stress: Eustress, Neustress, and Distress. Eustress is good stress and can occur in any situation that motivates or inspires a person. Neustress type stress can be neither good nor bad for a person who experiences it. Distress is a negative type of stress. (Seaward, 2017; Piperopoulos, 2019; Klinic Community Health Care, 2010). Having a proper understanding of stress types will help an individual deal with them successfully (Kapur, 2021). There are two main responses an individual shows when responding to a stressful situation. The fight mode is triggered by anger and the flight mode, which is triggered mainly by fear. (Seaward, 2017; Piperopoulos, 2019).

2.2. Technostress

Technostress arises when an individual experiences an inability to adapt when coping with new technologies. Technostress can have either a positive or negative impact on an individual. Yet the use of technology enhances an individual's overall productivity and efficiency. So, technostress is like a double-edged sword. (Upadhyaya & Vrinda, 2021).

2.3. Impact of Stress on University Students

According to previous studies, most university students have moderate stress levels (Thawabieh & Qaisy, 2012; Y. et al., 2018). There are various types of stressors triggered for numerous reasons. The stress that causes academic pressure is called "academic-related stress". This academic stress could either negatively or positively impact college students. Because of academic-related stress, academic achievement can be reduced. (Pascoe et al., 2020; You, 2018).

2.4. Common Stress Factors among University Students

Tables Dissatisfaction with lectures, the breadth of the academic curriculum, worry about the future, lack of supervision, competition with peers, and expectations of parents were common stress factors among students (Chowdhury et al., 2017; Bedewy & Gabriel, 2015; Reddy et al., 2018). According to previous research, there are

twelve common sources of stress among undergraduate students. Starting a new semester is the most common source of stress, while attending a class that one hates is the least common of the twelve sources (Elias et al., 2011).

2.5. Coping Strategies Used by University Students

Coping is a technique used by individuals to overcome stress. Mainly, the coping strategies can be categorised as problem-focused coping and emotional-focused coping.

Through problem-solving, decision-making, and/or direct action, efforts are made to change stressful situations. In emotion-focused coping, attempts are made to regulate distressing emotions, sometimes by changing the meaning of the stressful situation "cognitively without changing the situation" (Mohamed & Baqutayan, 2012). Problem-focused coping is more of a positive coping strategy, while emotional-focused coping is more related to negative coping (Amponsah et al., 2020). The coping strategies used by the students can be either productive or non-productive (Y. et al., 2018).

There are 18 problem-focused and emotional-focused coping strategies that have been identified as most common among university students, including seeking social support, focusing on solving the problem, working hard, wishful thinking, and focusing on positivity (Lewis & Frydenberg, 2002). A person who has practiced a proper coping strategy can adapt to any situation and manage it (de la Fuente et al., 2017).

2.6. Impact of Stress Based on Gender, Degree Discipline and Academic Year

Some studies proved that there were no gaps in experiences of academic stress between male and female students (Bedewy & Gabriel, 2015; Y. et al., 2018), and females have a better resistance to stress than males (Behere et al., n.d.). However, many studies proved otherwise, stating that female students experienced higher levels of depression and anxiety than male students (Calvarese, 2015; Kizlik et al., 2018; Misigo,

n.d.; Bayram & Bilgel, 2008; Feyissa Amhare et al., 2020; Dahlin et al., 2005; Alsulami et al., 2018). As for the coping methods, women are more likely to use emotional and avoidance coping strategies, whereas men are more likely to use problem-focused coping (Stress and Gender: 2011, n.d.; Matud, 2004; Misigo, n.d.).

According to numerous previous studies, medical, health science, and engineering students had the highest stress levels (Behere et al., n.d.; Dahlin et al., 2005; Elias et al., 2011; Feyissa Amhare et al., 2020). However, some studies indicated contradictory results, stating that social and political science students have higher stress levels than basic sciences, engineering, or medicine students (Bayram & Bilgel, 2008; Thawabieh & Qaisy, 2012). Moreover, there was a significant decrease in, Physical Education students' stress, anxiety, and depression scores as the years increased, maybe due to the physical activity-based education, which also helps build strong interpersonal relationships (Aktekin et al., n.d.).

The majority of studies found that as students' years of study progressed, their perceived stress levels decreased (Bayram & Bilgel, 2008; Feyissa Amhare et al., 2020; Dahlin et al., 2005; Alsulami et al., 2018; Thawabieh & Qaisy, 2012). However, some studies proved otherwise, stating that reasons such as higher education content, considerations about job opportunities, and internships after graduation may trigger more stress on final-year students (Elias et al., 2011).

2.7. Use of Technology to Reduce Stress

Even though it is essential to avoid higher usage of technology to be healthier (Thomée et al., 2007), these digital technologies can also be used as an aid to reduce stress (Tucker & Goodings, n.d.; Ozyurek et al., 2015). However, its benefits compared to traditional methods are unclear. Self-service technologies as part of stress management provide adequate support for the healing process (Sophia & Morris, 2012). According to previous studies, internet-based self-help approaches proved to be more effective (Zetterqvist et al., 2003). Yet, the public

awareness of self-service technologies was low, and people displayed a neutral attitude toward self-service technologies (Apolinário-Hagen et al., 2018). Some studies state that most people have positive attitudes toward using self-service technologies (Ozyurek et al., 2015; Apolinário-Hagen et al., 2019). A digital intervention designed to support stress management should contain personalised solutions for the target group and help even less-motivated users to manage their stress (Ervasti et al., n.d.).

Based on many studies conducted using various platforms, the mobile platform was identified as the most suitable for stress management because of the wide availability of mobile phones. Hence, it allows users to perform stress management exercises anywhere and at any time, enabling easy access to core content (Morrison et al., 2018; Serino et al., 2014). There are five essential needs for stress management applications as follows: they should be easy, calming, and relaxation exercises that can easily be integrated into daily life, be able to be used anywhere at any time, should enable self-improvement and learning new skills rather than external reward or gaming elements, should be guided but not restricted to making choices, and should provide an easy and flexible tool for self- reflection (Ahtinen et al., 2013). Furthermore, it is essential to embed social interaction components into digital media designed to address psychological issues (Tucker & Goodings, n.d.).

2.8. Perceived Stress Scale

The Perceived Stress Scale (PSS) is the most frequently used psychological tool for assessing stress perception and was originally developed in 1983 (Cohen, 1994). In PSS 10, there are 10 questions, including six negatives and four positives, rated on a 5-point Likert scale. The questions on this scale ask about the thoughts and feelings during the last month, and according to the respondents' answers, a total score is given to measure the stress level as low, moderate, or high (Cohen, 1994).

3. METHODOLOGY

3.1. Research Design

The research was quantitative and followed the survey methodology to explore the design requirements of the proposed ICT intervention. The entire research process adopted the design science framework proposed for the information system design and development process. The framework adopts a three-cycle approach; rigor, relevance, and design (Hevner & Park, 2004).

The target population comprised state and non-state university students in Sri Lanka, and 233 responses were selected as the sample. The random sampling technique was used to determine the sample.

3.2. Data Collection Methods

Data was collected with the help of a questionnaire-based survey distributed among the target population via online platforms. The twenty-nine questions in the survey were used to gather data for the study under four main sections.

4. RESULTS AND FINDINGS

4.1. Demographic Factors

This study included 62.2% female students and 37.8% male students. The majority of students (57.5%) were non-state university students between the ages of 23 and 26. (54.1 %). Furthermore, many of them were second-year (29.2 %) full-time (79%) students studying computing (38%).

4.2. Stress Levels and Stressors

According to the PSS10 scale, the majority of respondents (68%) were experiencing moderate stress (100 females and 58 males), with 26% experiencing high stress (37 females and 24 males) and 6% experiencing low stress (8 females and 6 males).

Many students (22%) were stressed because of project or assignment timing and deadlines, while 20% were stressed because of grades and GPA.

Study findings showed that there was no significant relationship between the level of stress and gender (p = 0863), academic year (p = 0.090), and university category (0.193) of university students in Sri Lanka. But there is a significant relationship identified between the level of stress and the degree of discipline (p = 0.000).

4.3. Coping Strategies

The majority of students were using coping strategies such as listening to music (15%), using social media (11%), and watching videos (11%).

### 4.4. Perception on ICT Intervention

Only 77 (33%) of the 233 respondents were aware of ICT interventions used to manage stress, whereas 51 of 233 (21.9%) have previously used stress management applications. However, 172 (73.8%) of 233 respondents were interested in using an ICT intervention. The mobile application was as it was the most preferred platform by 93 respondents out of 233.

4.5. Feature Selection

- Based on the majority of responses, six core features were selected to be included in the application.
- Calming and relaxation music player.
- Workload organizer.
- Motivational videos.
- Meditation guidance and audio therapy sessions.
- Yoga and relaxation exercise guidance.
- Digital diary.

In addition, the non-functional features include the ability to create personalised playlists and user accounts, provide social media linkage, privacy, simplicity, push notifications, consistency, usability, reliability, and high performance to improve the user experience.

Figure 1. Sample Interfaces of the proposed system (Main Interface, Sign up Interface, Main
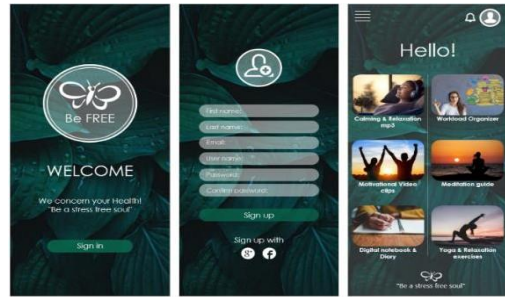
menu/ Home page Interfeace).

Figure 1 contains samples of three main interfaces of BeFree app, namely, the main interface, the sign-up interface, and the main menu/home page interface, out of 30 plus interfaces included in the wireframe design of the application.

5. DISCUSSION

Being in the digital age has made the younger generation more familiar with the technologies. People tend to think that digital technologies increase stress, yet they can be used to reduce stress with the correct guidance. (Tucker & Goodings, n.d.; Ozyurek et al., 2015). The younger generation's technological fluency allows them to easily familiarize themselves with the new technologies and capture the positive impact of technostress (Upadhyaya & Vrinda, 2021).According to the research findings, the majority of the participants had moderate stress levels, in line with the previous studies (Y. et al., 2018; Thawabieh & Qaisy, 2012).

The most common stress factors among respondents were project and assignment deadlines, academic grades and GPA, personal relationships, and family issues and financial matters. Similar to previous research findings the students' stress levels were increased by their parents' and families' expectations, flaws in educational systems, examinations, and academic self-perceptions (Bedewy & Gabriel, 2015; Chowdhury et al., 2017;Y. et al., 2018; Reddy et al., 2018).

There was no significant relationship between the gender of a person and their stress level, which was similar to some previous studies (Y. et al., 2018; Bedewy & Gabriel, 2015) yet contradictory to the majority of past research, which has proven that females have higher stress levels than males (Stress and Gender: 2011, n.d.; Calvarese, 2015; Kizlik et al., 2018; Bayram & Bilgel, 2008; Feyissa Amhare et al., 2020; Dahlin et al., 2005; Alsulami et al., 2018). One of the reasons for the present study's contradictory results could be the smaller sample size, which was not enough when comparing the target population of this research.

The majority of participants were unaware of the ICT interventions used for stress management and hadn't used them either, which was similar to the previous study where participants showed a neutral attitude towards such interventions and the awareness level was also low among the participants (Apolinário-Hagen et al., 2018). However, the majority of participants showed an interest in using ICT intervention to manage stress. Even if some previous studies stated that ICT may impact psychological health,it is essential to avoid higher usage of technology (Thomée et al., 2007). Nevertheless, the majority of previous studies displayed participants; positive attitudes towards the use of ICT interventions (Ozyurek et al., 2015; Sophia & Morris, 2012; Zetterqvist et al., 2003).

The most preferred platform was the mobile platform. Mobile applications are more useful for stress management than other platforms because they allow users to access more content in less time. Furthermore, mobile phones are widely available and well- integrated into a person's life, allowing users to perform stress management exercises anywhere at any time (Morrison et al., 2018; Serino et al., 2014).

Based on the results, seven of the top-rated features were chosen to be embedded as six core features in the Be FREE app by combining two features due to their similarity. The feature set included a mix of problem and emotion-focused coping strategies. The application is designed to address the user needs of a stress-management intervention (Ahtinen et al., 2013) by including relaxation and calming exercises, allowing users to use it anywhere at any time. The application does not include any gaming components because people tend to focus on earning rewards that do not bring peace of mind; instead, it allows users to focus on learning new skills. By providing professional guidance on exercises, the application also provides them with the opportunity to select exercises according to their preference while also providing a tool for them to record their progress.

Although respondents were uninterested in the community forums and online community feature, users were given the option of linking their BeFree account with Facebook and Instagram in order to share their experiences on social media. This decision was made because social interaction is an essential feature for digital media designed to address psychological issues (Tucker & Goodings, n.d.). Moreover, one of the most common coping strategies among respondents is social media interaction.

6. CONCLUSION AND RECOMMENDATIONS

The proposed study attained all the set objectives by presenting the BeFree mobile application. This application is fully designed and developed according to the user needs gathered through a quantitative survey. Future research should try to generalise the solution more successfully across the population by replicating these findings with a larger sample size that better represents the population. Furthermore, the application can be improved further by including more features with a wide variety of styles and by attempting to personalise it. A qualitative investigation may be combined with the quantitative exploration to further refine and gather design ideas for the proposed intervention.

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International Commercial Arbitration in a Global Economy:

Where does Sri Lanka Stand?

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ABSTRACT

The development of trade, infra structure and business opportunities throughout the world has impacted and instigated alternative dispute resolution to be recognized as an essential means to resolve disputes among parties due to its many advantages over litigation. As Arbitration is the most popular alternative dispute resolution mechanism possessing the characteristics of being private and confidential in nature outside courts with quick results, it is no surprise that parties all over the world resort to alternative dispute resolution mechanisms like arbitration to resolve their disputes as a viable alternative. The great perplexity of arbitration is that it pursues the assistance of the very public authorities from which it wants to free itself. Therefore, one of the foremost problems in arbitration endures to be the strain that exists between courts and the arbitral process. The line demarcating the two processes are an intricate balance and while judicial support is fundamental, excessive intervention would diminish and disrupt the concepts such as party autonomy and efficient dispute resolution through arbitration. This research intends to analyze and determine the extent of court intervention at different stages of the arbitral process. The researcher further assesses and analyzes the provisions of the Arbitration Act No 11 of 1995, relevant case law, text books and articles in this area for the purpose of evaluating the extent of the involvement and intervention of courts in arbitral proceedings in Sri Lanka. The researcher will adopt black letter approach throughout the research. It is paramount to note that commercial arbitration in Sri Lanka too should take cognizance of the modifications and alterations and move forward towards the digital era, which would also succor in revitalizing the overall economy of the country. Confidence in the process of arbitration with its flexibility, relative speed and finality of decisions ensures growing reception globally of third-party adjudication of disputes. Dissemination of this concept might well turn out to be one of the most significant benefits of globalization. Hence, there is no skepticism that arbitration benefits from the multiculturalism of the world in which we live in, since it is the need to find a neutral system that fosters the resolution of conflicts through arbitration. There is no doubt that international business players benefit from the multicultural and flexible approach that arbitration provides, which would unswervingly impact on the economization and would be a sustainable adjudication strategy.

Keywords- Commercial Arbitration, Dispute resolution

1. INTRODUCTION

Sri Lanka possesses a noteworthy chronicle of dispute resolution dating back to over 2500 years. Sri Lanka, as a result of its location in the east-west trade route eventually befitted into a trade entrepot. Prior to the modern law

on arbitration which is the Arbitration Act no 11 of 1995 which is the current law on arbitration, previously statutes such as the Arbitration Ordinance no 15 of 1856, Chapter 51 of the Civil Procedure Code No 2 of 1889 and the Reciprocal Enforcement of Foreign Judgements Ordinance No 41 of 1921 prevailed with regard to arbitration. The striking feature of the Arbitration Act 1995 is that it was the very first arbitration in South Asia that was grounded on the United Nations Commission on International Trade Law (UNCITRAL) Model law on International Commercial Arbitration and was also influenced by the draft of the Swedish Arbitration Act.

Alternative dispute resolution is preferred over common adjudication methods due to conflicting national laws, lack of specialist expertise and the substantial demands made in terms of time and money in the court structure as opposed to alternative dispute methods like arbitration.

An important feature of International commercial arbitration is that disputes are brought before a neutral third party and this process opens up possibilities for alternative methods of resolution of conflicts which may acclaim themselves to either or both parties as being speedier and more confidential. Furthermore, parties have the option of selecting the arbitrators, the place of arbitration and the legal or regulatory code in which proceedings will be conducted.

Having emphasized on the importance and growing popularity of resolving disputes through alternative dispute resolution; with the attention on international commercial arbitration, the need arises to demarcate the clear-cut line between arbitration and litigation.

One of the major problems in arbitration endures to be the tension that exists between courts and the arbitral process. The line demarcating the two processes are a delicate balance and while judicial support is fundamental, excessive intervention would diminish and disrupt the concepts such as party autonomy and efficient dispute resolution

through arbitration. The recent speech by Justice Andrew Phang at the China-ASEAN Justice Forum depicts and highlights this view as; ' A pro-arbitration policy is one that acknowledges the boundary between national courts and arbitral tribunals as having a co-existence and alliance and that which finds the correct equilibrium to further the efficiency and legitimacy of arbitration and respect for the parties' autonomy. This is portrayed by the apparent setback of the minimum intervention approach when the courts are expected to play a supportive role.' (Phang, Alternative Dispute Resolution and Regional Prosperity: A view from Singapore, China ASEAN Justice Forum) Thus it is believed that Singapore has risen and developed as an arbitral friendly arbitration hub as well as an appealing focal point in the World for commercial arbitration as a result of the effective and supportive Singaporean courts. The Singaporean courts' judicial attitude which reflects their stance of cogitating arbitration as a complementary as well as analogous mechanism to court process and also the effective practice of minimal court intervention could be cited as apparent reasons for the global acuity and recognition of Singapore as an exceptional seat for arbitration. It is thus ostensible that the delicate relationship which exists amongst the courts and arbitral tribunals does not necessarily need to be cast in a negative light. (Blog) As Lord Mustill observes; ' the courts must work in partnership, not superiors or antagonist in a process which is vital to commerce at home or abroad'.

2. LITERATURE REVIEW

2.1. Arbitrability of a Dispute

The concept of Arbitrability assists in determining whether a dispute can be resolved by arbitration or by courts. (Hunter, 2015) Therefore this concept aids in providing a clear demarcation of disputes between arbitration and the domain of the courts. Arbitrability is a fundamental concept in the law of arbitration as disputes which are not arbitrable cannot proceed to arbitration. In circumstances in which a party intends to raise an objection on

arbitrability of a dispute, such an objection should be raised as a preliminary issue to be decided forthwith. (Ranin Kumar, Proprietor, Messers Pharma Chemie v State Pharmaceutical Corporation, 2004)

2.2. **Competence- Competence**

The power which an arbitral tribunal possesses to decide upon its own jurisdiction is considered as an 'inherent' power. Nevertheless the common exercise under modern international and institutional rules of arbitration are to mention in express terms the powers of an arbitral tribunal to adopt and determine upon its own jurisdiction or in other words its competence to decide upon its own competence. (Redfern A, 2004) This is commonly denoted to as the doctrine of competence-competence. The doctrine of competence-competence is also recognized in international institutional rules such as ICC rules which provides that; Unless otherwise provided, the arbitral tribunal shall not conclude to have jurisdiction by reason of any claim that the contract is null and void or for allegations that it is non-existent as long as that the arbitral tribunal upholds the validity of the arbitration agreement. (6.4) Under the Arbitration Act no 11 of 1995; section 11 acknowledges the doctrine of Competence-Competence which permits the arbitral tribunal to rule on its own jurisdiction, which includes any question with regard to the existence or validity of the arbitration agreement or whether such agreement is contrary to public policy or is incapable of being determined. (11(1))

2.3. **Party Autonomy**

A significant feature of international commercial arbitration is that the parties are free to decide for themselves and select the law and the legal rules which are applicable to the international commercial agreement as well as any procedural laws. Party autonomy had been pronounced as " a key principle of current arbitration law and the keystone of modern arbitration." (Bay Hotel and Resort Ltd v Cavalier Construction Co Ltd , 2001) Many countries and arbitration institutional rules

accept the doctrine of party autonomy which is the golden thread which runs along the process of arbitration. Sections 6, 7, 15, 16, 17, 22, 24 and section 38 of the Act (1995) are occasions by which the Sri Lankan national law recognized the concept of party autonomy. The Supreme Court of Sri Lanka has further confirmed the concept of party autonomy. (Merchant Bank of Sri Lanka Ltd v D V D A Tillekeratne)

2.4. **Section 5 and Ouster of Jurisdiction**

Section 5 was a noteworthy variation in the thinking behind the legislation in Sri Lanka in which the Courts' power and jurisdiction over arbitration agreements was taken away. Subsequently as a result the agreement and the desires of the relevant parties or in other words party autonomy at the time the contract was entered into was given more value on any substantive dispute that would arise out of the dispute. Conversely this is not a complete ouster of jurisdiction as with the development of the law, in very limited circumstances, the court in fact intervene despite the provisions of Section 5. The issue with regard to ouster of jurisdiction of court rests on the same side of the coin as that of the issue of arbitrability. It is trite law that the courts of Sri Lanka would not usually exercise its jurisdiction to hear a case that is already being subjected to an arbitration agreement. Where a valid arbitration agreement exists between the plaintiff and defendant that covers the dispute before the courts, the court must according to section 5 of the Arbitration Act No 11 of 1995; Stay its proceedings upon an objection by the defendant. However even in such a state, the High Court may have to rule on the subsistence or the validity of the arbitration agreement. (Elgitread Lanka v Bino Tyres)

3. GENERAL OVERVIEW OF ARBITRATION IN SRI LANKA

The remarkable and opulent folklore of dispute resolution Sri Lanka possesses dates back to over two thousand five hundred years. The convenient central locality in the East-West

trade route resulted in Sri Lanka being a trade entrepot. Furthermore the initial acquaintances with different trading countries aided the early Sri Lankans to progress a social configuration amid a conciliatory judiciary system. Before the adversarial dispute resolution system was initiated by the Dutch and the British, the early Sri Lankans mainly focused on the fundamental principles of arbitration for the determination of resolving their disputes. However in Sri Lanka before the emergence of the open economy in the seventies, Commercial arbitration was not prevalent as an effective alternative dispute resolution mechanism. At that time it was the court system that predominated to resolve disputes in matters relating to commercial activities.

As a result of the growth of trade both locally as well as globally; as a result of the open economy, Sri Lanka was in dire necessity of a more efficient and effective alternative dispute resolution contrivance to cater to its needs. In this milieu, the Swedish International Development Cooperation Agency (SIDA) volunteered to support Sri Lanka to develop and enhance the arbitration laws of Sri Lanka and to further improve the commercial arbitration at that time to a greater level. SIDA together with the Institute for the Development of Commercial Law and Practice (ICLP) assisted in the formation of the Arbitration Act No 11 of 1995 which emanated into subsistence on 30th June 1995 and afterwards became operative from 1st August 1995. (Wijeratne, 2011)

The most anticipated advancement headed for facilitation of international commercial arbitration in Sri Lanka was established mainly through the enactment of the new Act on arbitration, the (1995). As analyzed by Saleem Marsoof, the legislative intent as according to the new Act was to encourage arbitration being the modern advancement and approach to courts and the legislature of Sri Lanka. (Marsoof, Arbitration Procedure, Law and Facilities in Sri Lanka, 2009) This view is manifest through a careful analysis of the preamble to the Act. (Arbitration Act No 11, 1995) The preamble itself indicates that it is an

Act to provide for the demeanor of arbitral proceedings and further to give effect to the Convention on the recognition and enforcement of foreign arbitral awards. (11, 1995) This contemporary statute has its ancestries embedded in the UNCITRAL Model law which additionally gives effect to an internationally renowned standard that is applied in the arbitral process. By the introduction of the novel Arbitration Act it is manifest that the legislature envisioned to promote international commercial arbitration in Sri Lanka. It is Justice Marsoof's opinion that the judiciary of Sri Lanka is well postulated with the necessary tools to facilitate international arbitration. (Marsoof, Arbitration procedure, Law and facilities in Sri Lanka, 2009) Upon analysis of the findings, the extent of judicial intervention is clearly delimited through the Arbitration Act. (11, 1995) Mainly Section 5 of the Act averts judicial intervention when a valid agreement to arbitrate is in subsistence. K. Kanag-Isvaran PC, views that this section as the first legislative effort to restrain the powers of the court in intervening in arbitration proceedings. (Amerasinghe, 2007)

However this cannot be seen as a total ouster of jurisdiction and this section is unable to completely bar court intervention in the arbitral process as there are other provisions in the Act which promotes intervention. For instance according to Section 7 of the Arbitration Act; parties that do not have an arbitration agreement, can apply to the High Court to appoint an arbitrator. Similarly there are many provisions which enable court intervention such as appeals grounded on challenges made regarding arbitrators according to section 10, regarding competence of the tribunal as per section 11, interim measures as per section 13, summons procedure according to section 20, enforcement of awards under section 31 and during examination of witnesses under section 21 of the Arbitration Act (11, 1995) are some of the instances that the court involvement can be seen. Therefore, it is clear that the legislative intent by presenting a statutory framework with the objective of limited court intervention thus becomes only theoretical.

4. CASE AGAINST RADICAL DELOCALIZATION

The current attitude of many international as well as Sri Lankan parties to an arbitration agreement is in favour of radical delocalization or in other words total exclusion of the national courts from arbitration. However radical delocalization can in many instances be counter-productive to the arbitral process itself. Total eradication of courts results in there being no review, enforcement or recognition of an arbitral award and the parties to a dispute would therefore have no recourse to courts in any instance. The evolution of the Belgium arbitration law provides an excellent insight into the evolution of (1995) (1995) (1995) (Blog, The Singapore Approach to Scrutiny of Arbitral Awards) arbitration. Belgium is a jurisdiction that embraced the delocalization theory in a very radical form. However it is a positive feature that the Arbitration Act employs a middle path attitude between the seat and the delocalization theory. However it is paramount to note that the middle path journey avoiding excessive delocalization is in reality a desirable state to a developing country. It is also paramount to reminisce that there is a need to review the current Arbitration Act and laws which have remained immobile since 1995; to be in par with the Model Law which has been addressed to novel developments in the growing commercial world. Further developments to increase party autonomy within arbitration and the use of new technology to cater to the evergrowing community will no doubt raise Sri Lanka to be more competitive in the international arena of dispute resolution.

5. IMPLICATIONS OF THE STUDY

Sri Lanka is deliberated an excellent choice of location with regard to the facets of affordability, proximity, resources and accessibility. (Marsoof, Arbitration Procedure, Law and Facilities in Sri Lanka, 2009) Regardless of the aforesaid favorable characteristics, Sri Lanka is still not regarded as an anticipated seat of arbitration in the region. The importance of this research is that it delves into the process of arbitration; highlighting the extent of court intervention and critically analyzing the role played by the courts and how it affects arbitral proceedings eventually. It is commanding that the future requires a comprehensive as well as modern legal framework which supports and encourages arbitral process together with minimal judicial intervention and far-reaching judicial assistance. These requirements should be in place to ensure Sri Lanka to be a hub for international commercial arbitration, which would result in economic development and globalization.

6. RECOMMENDATIONS/ REFORM

The researcher proposes the following reforms to be embraced in the Sri Lankan arbitration regime for improved facilitation of international commercial arbitration in Sri Lanka: To Introduce provisions in Arbitration legislature by vesting administrative powers to the arbitral tribunal, such as powers to send summons, calling of witnesses, calling of documents to be under the purview of the arbitral tribunal, which are currently under the powers of the courts. The objective of such a reform would be to lessen the intervention of courts in the arbitral process. Such a reform would also provide towards the supportive role of courts in this process and by enhancing the common discernment and confidence on international commercial arbitration in Sri Lanka.

Contemplating other jurisdictions, we can establish a separate and distinctive court for the sole purpose of dealing with international commercial arbitration matters, by employing specialized recruits in the field of international commercial arbitration.

7. CONCLUSION

It is a known fact that commercial arbitration has encountered snags in the recent past. Further stringent procedures and statutory requirements have made the process of arbitration almost a replica of court proceedings. The intention of the legislature of

Sri Lanka to limit court intervention is reflected through the provisions of the Arbitration Act No 11 of 1995 which seeks to limit court intervention as to the best of its ability and to further encourage and promote for Sri Lanka to emerge as a popular and well-equipped hub for the conduct of international commercial arbitration

In developed jurisdictions, Commercial arbitration has been able to supersede litigation to resolve domestic as well as international disputes. Further in many jurisdictions and under many well known and reputed international arbitration institutes, it is common to witness expedited rules of arbitration implored by parties; which is a clear signal that the corporate world entails speedy results. (Cabral) With the growth of trade and commerce; Sri Lanka too would perceive a definite growth in the area of commercial arbitration if the systemic deficits are successfully addressed. With the improvement and advancement of technology worldwide together with the evolution of activities in the commercial world with advancements in e-commerce; the intact panorama of commercial arbitration has been altered internationally where most of the documentation, correspondence and even oral testimony are being carried out electronically. It is paramount to note that commercial arbitration in Sri Lanka too should take cognizance of the modifications and alterations and move forward to the digital era.

However, it is to be understood that the role of the courts cannot be completely dispensed as a complete ouster would result in causing miscarriages of justice. The importance of the supportive role of courts is encapsulated by the observations of a commentator as follows; ' The reality is that arbitration would not survive without the courts. Indeed as Lord Mustill observed, it is only a court with coercive powers that could rescue an arbitration which is in danger of foundering'. (Lurie, 2010) The substratum of an arbitration friendly jurisdiction be it domestically or internationally vestiges based on the issue whether national courts are supportive or

interventionist in their attitude towards arbitration. (Croft)

It is also imperative to ensure that the supportive role of the relevant courts which are the High court and Supreme court of Sri Lanka be enhanced if the objectives of arbitration are to be accomplished.

Increased globalization of business and expansion of international trade has led to a paradigmatic shift in the way international business disputes are being resolved. Furthermore, a robust framework for the purpose of resolving cross border commercial disputes can help unlock valuable trade and investment opportunities for many jurisdictions including Sri Lanka. If this can be achieved: it could be expected to make a considerable contribution towards strengthening trade and investment as well as boosting economic growth.

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Factors affecting to the success of virtual learning during COVID 19 Pandemic

(With reference to the students of XYZ School)

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ABSTRACT

The focus of this study was to identify the factors affecting to the success of virtual learning during COVID 19 pandemic with reference to the students of XYZ School who are engaged in virtual learning. The study focused on identifying the factors which would affect to the success of virtual learning during covid 19 in school level. Interaction between the teacher and the student, technological knowhow, monthly income level of the family and the clarity of the lessons were identified as the factors. Quantitative design was used and to carry out this study, data were collected from students in grade 5 to 13, who are engaged in virtual learning through a questionnaire. Frequency descriptive analysis, correlation, coefficient, and linear regression were tested for the formulated hypotheses using the SPSS statistical software. The results of the study revealed that there is a significant positive impact of above-mentioned factors to the success of virtual learning. This study has identified the weakness of the current process and this study provides suggestion to increase the effectiveness of virtual learning.

Key words: Virtual learning, Covid - 19

1. INTRODUCTION

COVID 19

The COVID-19 pandemic, also known as the coronavirus pandemic, is a new global pandemic (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The outbreak was first identified in December 2019, in Wuhan, China and the first case of the virus was confirmed in Sri Lanka on 27 January 2020. As of 1st November 2021, there were a total of 551,000 confirmed cases, and 13,995 deaths reported in Sri Lanka.

From 13th of March 2020 to 27th of July 2020, all schools and universities in Sri Lanka were officially closed for almost 4 and half months because of the first wave. Then the schools were again closed due to the second and third waves. After a long period of one and half years, all schools are opening in the month of November across the country.

Virtual learning is a learning environment that is improved both outside and within the educational organization's facilities by using computers and/or the internet. In response to school closures, UNESCO proposed using distance learning platforms and open educational tools and networks that can be used by schools and teachers to remotely access learners and minimize disruption to education.

Akura/Aspitio is the learning management system used by many schools to upload lesson videos and worksheets which can be downloaded at any time or watched more than one time.

2. PROBLEM STATEMENT

XYZ school provided solutions to the students for their education during COVID 19 pandemic through online teaching and it has not been hundred percent successful according to a survey conducted by the school. The school reached the students through the Akura learning management system which can download videos at any time and watch lesson videos by repeating. It was evident that most of the students of XYZ school did not watch and complete their worksheets because of inability to access the system due to the negative influence of the below independent variables.

In an online class environment, the interaction between the teacher and the students are very low. There are minimum ways to ask questions and sort out students' questions regarding lessons as there is no interaction between the teacher and the students. The relation between the teacher and the students is an important part of the teaching and learning process. The interest of learners in the classroom is increased by contact in the classroom. It fuels students' excitement and lets students see the value of teachers. Virtual learning distant the contact between the teacher and the student as compared to classroom/traditional learning. Virtual learning is a new concept to the Sri Lankan teachers, students and parents. There are some difficulties to get familiar with virtual learning. Technological expertise implies knowledge of the use of specific innovations or of a more reliable and effective way of doing things. It is mandatory for the teachers, students and parents of young students to have the technical skills to effectively operate the Akura Learning Management System.

COVID 19 pandemic is an unexpected situation. In this period most of the people have been suffer from negative economic circumstances such as salary reductions, bonus cutoffs, loss of business etc. In the survey conducted by the school, it is identified that the average usage of internet per student during a month is nearly 20 GB. Parents have to pay unexpected internet bills while suffering from their salary reductions. There are more than one child in some families who are engaged in virtual learning and they have pay double or triple amount of money for internet bills compare to the normal monthly payment. Another issue is some students do not have proper electronic devices due to the money problems to engage in virtual learning.

As this is a new experience for teachers, they do not have proper knowledge about how to make a video, how to edit, how to dub and how to do all that in a practical manner. This is negatively affecting to the success of virtual learning.

Accordingly, the research was conducted to explore the research question, what are the factors affecting for the success of virtual learning of the students of XYZ School?

Further the research will focus to identify the factors, affect to the success of Virtual learning during COVID 19 pandemic, to Identify the weaknesses of online learning and to offer possible recommendations.

The significance of this study is finding the best solutions for the factors affecting negatively to the success of virtual learning. As this virtual learning is a new face of education, most of the students, teachers and schools/universities/education institutes in the world have faced difficult conditions. On the bad side, there is no proper awareness about online education in a country like Sri Lanka. The panicked students and parents express their anger in a variety of ways, including calling for refunds. Some parents have even gone so far as to file action cases requesting

cash back from the school. Most of the teachers who have struggled in the online environment and have not obtained adequate assistance from their schools or colleges.

3. THEORETICAL FRAMING

Advanced learning is a learning experience that, by utilizing PCs or potentially the web, is upgraded both outside and inside the offices of the instructive association. Most as often as possible, the preparing happens in an online climate. In online systems, the exercises are completed on the web, isolating the instructor and students actually (as far as area, time, or both).

We can characterize virtual learning as: distance learning with electronic exploration material streamlined for self-guided (nonconcurrent) or live web-conferencing (simultaneous) web-based instructing and coaching in a virtual picking up setting. It will likewise be to advance the term of collaborations financially in the method of conveying on the web, as opposed to tolerating interruptions inside the four dividers of the homeroom. Furthermore, in online study forums, commitment with accentuation is underlined in light of the fact that understudies are allowed to decide to do their realizing where it is generally helpful, as opposed to getting the information directed to them in a customary manner in school and conversing with schoolmates and educators.

3.1. Interaction among the teacher and students

Some would guarantee that the learning destinations are not satisfied by the understudies because the nature of what training can incorporate is missing: sensible and different information on a scope of functional things as opposed to book subtleties alone. The actions presented for the sake of norms and responsibility are the result of a large part of the current emergency. This way of talking tracks down a prepared audience who needs to openly oppose better standards, yet the skeleton in the closet of American instruction in the last part of the 1990s is that

genuine tutoring is being constrained out of schools on the grounds that time to get intense for individuals know nothing about schooling. The advantage of this educating and connection style is the undertaking of raising assumptions, which goes with the example of meager change in scores on ineptly built normalized assessments. As schools invest in working on their styles, they will undoubtedly be available to the chances to learn in a significant manner.

This exploration gives proof of the importance to the adequacy of online conditions of teacher – student connection. With these discoveries, we are assisting with responding to late requests for further examination into context-oriented variables that influence the adequacy of internet learning. The consequences of this exploration, from the writing audit, uncovered that understudy showed a serious level of on the web learning fulfillment. The understudies additionally exhibited inspirational perspectives overall towards the web-based learning climate. Furthermore, the discoveries of the writing showed that understudies seen that they acquired from web-based learning on the grounds that the style of online schooling gave them with learning adaptability and openings for more contact with teachers. Nonetheless a few investigations have shown that internet learning in traditional eye to eye classes will really be more troublesome than learning. (BMC Medical Education 20,Article number :285(2020) Understudies brought up that when there are time region changes and the shortfall of vis-à-vis associations among the 1348 understudies in online conditions, it was difficult to associate with their companions. Along these lines in instructing understudies through internet educating, instructors assume a significant part. Subsequently, in their own subject matters, they ought to have the opportunity to instruct eagerly and be dynamic. Kohn proposes (Alfie Kohn, 2008)that the agreement that we need harder principles is firmly identified with the idea that we need to work on the educating also, learning style and what could be known as the informative pack of realities model. Conservatives normally expect that by making

the teacher remain before the class, maybe composing on the chalkboard while spewing information that every other person in the room is required to drink up and duplicate down, we can cause understudies to learn by the sheer power of instructional educating.

At long last, pursuers ought to be advised that the writing on elective web-based learning rehearses has been directed generally by educators and different teachers who are leading exploration utilizing their own courses. Furthermore, Smart and Capel contended (C Riegel · 2016) that the discoveries on the web learning and web based instructing give pieces of information on how online segments and techniques could be applied in the 21st century to improve instructing and learning, particularly as instructors work to effectively draw in understudies in learning, give certifiable learning settings, and support basic thinking and profound learning. At last, it says that there ought to be an appropriate communication between instructor and the understudy for the accomplishment of web-based learning.

3.2. Technological knowhow

For a while, school entryways across the world have been shut to stay away from the spread of the Coronavirus pandemic. We have seen an uncommon number of huge scope endeavors to utilize innovation on the side of far off getting the hang of during this emergency. Simultaneously, the emergency has featured the issues confronting instructive innovation, including a few imbalances, starting with the absence of admittance to PCs and the Internet

School closures have affected 1,6 billion students in 194 countries. (https://www.gstic.org/) The UNESCO insights on school terminations set off by COVID-19 mirror the enormous impact of the pandemic on training around the world. At its stature, toward the start of April 2020, more than 91 percent of the worldwide understudy populace was affected by public terminations of instructive foundations. In supreme numbers, this implies that practically 1.6 billion understudies have been influenced by

the closure of schools in up to 194 nations. (https://www.gstic.org/)

The COVID-19 pandemic has given us enormous experiences into how the job of innovation can significantly change to arrive at 1.6 billion understudies and how learning cycles can be adjusted in troublesome occasions because of its broad impacts. (https://www.unicef.org/) How would we ensure proceeding with admittance to schooling? What's more, how would we help uprooted understudies from schools? Digital technology in education enables us to find new answers to these issues.

In instruction, arising innovation helps us not exclusively to discover new responses to what individuals realize, yet additionally to how they realize, where and when they learn. In addition, advanced innovations will assist with expanding the situation of instructors. They may become co-makers of information, mentors, coaches, and evaluators, as opposed to just sharing information.

For example, existing advanced learning frameworks may go a long way past simple educating. These frameworks, engaged by Artificial Intelligence, may likewise break down how understudies learn. Likewise, they will discover what sort of exercises and sentiments they are generally intrigued by, and what sort of issues they discover exhausting or testing. The learning cycle would then be able to be altered by these projects to fit the learning styles of individual understudies. What's more they can do this with a lot more noteworthy exactness than any regular study climate might ever achieve. However, how powerful is advanced innovation in instruction? Albeit advanced innovation has assumed a critical part in guaranteeing proceeded with admittance to schooling in late months, we should fundamentally ask ourselves the accompanying inquiry: How fruitful has advanced innovation been in arriving at the almost 1.6 billion understudies affected by school terminations?

Some calming measurements in this regard are distributed by the Organization for Economic

Cooperation and Development (OECD). Across OECD countries, on average,9% of 15-year-old understudies don't have a peaceful spot to concentrate in their homes, and this is disproportionally the situation among burdened students, only about portion of 15-year-olds are selected schools where a web-based learning support stage is accessible. Another significant viewpoint is the manner by which well educators are ready and occupied with internet learning.

Instructors should be engaged with arranging so innovation addresses their informative needs. If not, they won't keep on accepting computerized innovations whenever things have gotten back to ordinary. Instructors likewise should be adequately prepared, obliging for their degree of solace furthermore, experience with innovation. Neighborhood innovation champions who can impart best practices to partners are significant in such manner.

It is much more calming to track down that portion of the COVID-19 understudies (near 800 million understudies) kept out of the study hall don't approach a family PC. 43% (around 700 million understudies) don't approach the web at home. Furthermore, almost 56 million understudies live in regions not served by cell organizations. It obviously exhibits that with the presentation of computerized answers for distance learning, issues in keeping up with instructive coherence don't end. We should likewise consider the way that instructive innovation would not enhance social disparities and won't fuel the advanced gap. If we don't do that, if schools shut down, understudies from hindered foundations will stay shut out, particularly those understudies who don't have the versatility, learning methodologies or obligation to learn all alone.

We need to focus on shutting those computerized divisions to guarantee that advanced innovation offers equivalent and comprehensive admittance to training. Indeed, even where it is attainable and reasonable to get on the web, extra measures are needed to enable gatherings that are prohibited.

Ventures like Close the Gap and furnish training projects in agricultural nations with great used PCs are only one illustration of how we can achieve this. We will talk about more difficulties and openings on the best way to connect the advanced separation in schooling at the G-STIC gathering.

The unexpected public move to Distance Learning has highlighted the impact on schooling of destitution. Teachers were left attempting to acquire the necessary devices for virtual learning, and with practically no financial plan. Thus, many understudies around the country have been abandoned, large numbers of whom have effectively confronted boundaries to getting to the instruction they merit, like food frailty, family precariousness, as well as vagrancy.

Indeed, even before Distance Learning, instructors attempted to give understudies the devices they required to dominate. Families with low wages are frequently unfit to bear the cost of homeroom gear, and school financial plans keep on confronting cuts. This leaves no decision for educators except for to go through their own money ($745 per year all things considered) to stock their homerooms including fundamental supplies to innovation.

3.3. Online Collaborative Learning (OCL)

Online Collaborative Learning (OCL) is a hypothesis proposed by Linda Harasim that spotlights on the Web's offices to give freedoms to discovering that energize coordinated effort and information building. Harasim characterizes OCL as another way of thinking of discovering that spotlights on vivid learning, the advancement of data and the utilization of the Internet to reshape the formal, non-formal and casual training of the Knowledge Age (Harasim, 2012, p. 81).

Harasim, like Siemens, sees the upsides of moving instructing and figuring out how to the Internet what's more, organized

training for an enormous scope. From multiple points of view, Harasim utilizes Alberto Barabasi's position on the force of organizations. In OCL, three phases of information building happen in a local area through talk:

1. Thought creating: the way toward conceptualizing, where unique thoughts are gathered.

2. Sorting out thought: the stage wherein contemplations are differentiated, assessed, and grouped through discussion and contention.

3. Scholarly union: the phase of scholarly union and understanding, typically through a mission, paper or other joint piece of work, including the choice to clash (Harasim, 2012, p. 82).

Through the review of literature, the researchers propose the below conceptual framing and the hypothesis for the research.
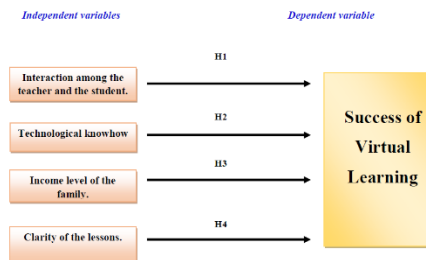
H1 - There is an effect of interaction among the

teacher and the student to the success of virtual

learning.

H2 - There is an effect of technological knowhow to the success of virtual learning.

H3 - There is an effect of income level of the family to the success of virtual learning.

H4 - There is an effect of clarity of the lessons to the success of virtual learning.

4. METHODOLOGY

The researchers used the quantitative design for the study. Data were gathered from a survey questionnaire which had a set of demographic questions and items using Likert scale. Convenient sampling technique was used students from grade ten to thirteen classes via a google link. 112 responses were taken for the data analysis. Data were analysed using SPSS statistical package and interpreted regression and correlation analysis, mean, mode and median etc for the discussion.

5. DATA ANALYSIS AND RESULTS

Summary of the Reliability Test

Variable Name	Cronbach Alpha Value
Success of virtual learning	0.768
Interaction between the teacher and the student	0.792
Technological knowledge	0.712
Income level of the family	0.754
Clarity of the lessons	0.770

As per the summary of "Reliability Test" Cronbach's Alpha value of all the variable is above 0.7 and it is considered as acceptable value. Hence data collected through questionnaire can be accepted for the study.

5.1. Correlation, Coefficient and Actual Results of Hypothesis

Correlation, Coefficient and Actual Results of Hypothesis

Hypotheses	H #	Alternative Hypotheses	Null Hypotheses	Relationship	Correlation coefficient	Significance
Interaction among the teacher and the students	H1	Accepted	Rejected	Small Positive	0.273	0.006
Technological knowhow	H2	Accepted	Rejected	Small Positive	0.201	0.045
Monthly income level of the family	H3	Accepted	Rejected	Small Positive	0.226	0.024
Clarity of the lessons	H4	Accepted	Rejected	Moderate Positive	0.316	0.001

The benchmark of 2 tailed significant is 0.05. All the significant 2 tailed values are below 0.05 and it can be accepted alternative hypothesis and deny the null hypothesis.

6. CONCLUSION

After analyzing the outcome of data analysis, I can conclude that,

- There is a positive relationship between interaction between the teacher and the student and the success of virtual learning.

- There is a positive relationship between technological knowhow and the success of virtual learning.

- There is a positive relationship between monthly income level of the family and the success of virtual learning.

- There is a positive relationship between clarity of the lessons and the success of the virtual learning.

7. PRACTICAL CONTRIBUTION

Online learning is a new to all the school students in Sri Lanka as well as students of the study. Not only for the students, but it is also a new topic for the teachers or instructors as well. This study has identified 4 factors which have positive relationship with the successes of virtual learning. Below are some suggestions to improve each factor influencing the success of virtual learning.

7.1. Interaction among the teacher and the students.

As explained before, teachers of the study must make lesson videos and upload to the Akura learning management system weekly. Because of that there is a zero interaction among the teacher and the student. We would like to suggest the management of the school to arrange a live discussion weekly with students to discuss the unclear parts of the lessons which has uploaded during that week. This can do individually or class wise. Not only for the lesson discussion, but teachers can also have a casual chat with their students through this method to improve their relationship and to provide students with some moral and mental support in this difficult time.

7.2. Technological Knowhow

As online learning is a new thing, some parents and students who have no experience about online tool must learn it, which is not easy. We would like to suggest the management of the school to provide proper guidelines regarding how to use Akura learning management system through a demonstration video. This is a new thing for the teachers as well. There should be proper instructions about how to make and edit lesson videos via multiple video editing apps. Assign an IT professionals to solve problems and it should be allowed to contact easy by the students, parents, or teachers.

7.3. Income level of the family

During the COVID 19 pandemic, most of the people faced salary deductions and loss of business revenues unexpectedly. The monthly income of them has been reduced due to that. Because of the virtual learning they must pay unexpected

connection bills due to the use of internet and some families had to upgrade their data packages as well. Most of the families had to face increasing of payments while facing the deduction of income. Approximately 10 GB has been utilized per week by a student for virtual learning purposes. Sometimes, there are more than 1 child in a family who engaged in virtual learning and those families must pay huge amount of bills. It is very difficult to afford the internet cost. I would like to recommend to the management of the school to buy GB as a bulk by getting considerable discount from the internet service provider and make arrangements to distribute those data among the low-income earning families by charging a reasonable amount. Aware the parents and students about internet packages and special offers which introduced by service providers during the time.

7.4. **Clarity of the lessons**

As this virtual learning is new to the students, some students take time to adapt to it. It is very important to make the lessons clear than the classroom learning, because children could not ask questions due to the virtual learning. I would like to recommend organizing a training program regarding how to make lessons videos clearly and attractive manner. There should be a proper inspection of videos before upload in the Akura learning management service.

The study was conducted in a private school in Sri Lanka. The researchers suggest that the same research need to be conducted in government schools in both urban and rural areas to get a holistic picture of the factors which can influence the effectiveness of virtual learning of school students.

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Impact of Brand Image, Brand Affect, Brand Trust on Customer Brand Extension Attitude: The Mediating Role of Brand Loyalty

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ABSTRACT

Manufacturing companies operate in a strong competitive environment due to the homogenous nature of their marketing activities and always look for new marketing strategies to be competitive in the marketplace. Fierce competition forces the manufacturing companies to get a competitive advantage over the competitor to remain in the market and gain a higher market share. Therefore, brand extension has become crucial to differentiate themselves from others to attract prospective customers. Despite many benefits achieved by implementing successful brand extension strategies, several obstacles negatively influence both the extended brand and the parent brand. Although the literature has recognized the role of brand extension in general product purchase, little is known about how products with different brand images, brand affect, and brand trust affect brand extension from the perspectives of the customers. Further, a dearth of literature remains on the mediating effect of brand loyalty towards the brand extension attitudes of the customers.

Accordingly, the main objective of this study is to examine the extent to which brand image, brand affect, and brand trust influence the customer brand extension attitude in the manufacturing sector in Sri Lanka. The present study considers the mediating effect of brand loyalty in developing the relationship between the study constructs.

For this study, descriptive and inferential statistical analyses were employed to show the associations and predictive abilities of the independent variables within each construct. Statistical Package for Social Sciences (SPSS) version 21 was used to analyze the quantitative data.

The quantitative findings from 200 customers indicated that brand image, brand affect, and brand trust develop brand extension attitudes among the customers. Brand loyalty was found to mediate the effect on customer brand extension attitude. The findings of this study enrich the marketing literature and have implications for manufacturing companies in developing customers' attitudes through a variety of branding strategies.

Keywords : **Brand Image, Brand Affect, Brand Trust, Custormer Brand Extension Attitude, Brand Loyalty**

1. INTRODUCTION

The brand is one of the important components which can form a positive image in the mind and the eyes of the consumer to make itself different from the competitor brands (Ahmed et al., 2014). A consistently enormous number of new products in various classifications have propelled the world over. In recent years, the implementation of new products is very difficult because of increasing competition and high advertising costs. Value decrease is certainly not a decent procedure for an association having strong brand value as it impacts the value adversely. The better course of action is the enhancement/changes or a new item in the current item portfolio. Furious contention powers great associations to get the upper hand over the contender to remain in the market and meet with a high share of the overall industry (Anwar et al., 2015).

Ceylon Biscuits Limited (CBL) is one of the fast- growing and biggest aggregates in Sri Lanka that makes and markets many topmost brands in Biscuits, Organic natural product things, Soya based item, Confectionary and numerous different classes all around the globe. Perceive as and development and progression driven maker, CBL considers a far- reaching abroad market and has a worldwide across all continents.

The manufacturing of biscuits is one of the most profitable for Sri Lankans profession. Most of the Sri Lankans' favorite is rice, Chocolate favor milk, cool drinks, and crunch biscuits. However, most people think which biscuit is to buy? In Sri Lanka competitor brands Munchee and Maliban make unique featuring products and their expense is at the same level and even the companies' logos look similar. Use of white front on red, both start with letter of 'M'. Therefore, it is a challenge when deciding which one to go for.

1.1. Problem Statement

The reason for this investigation is to run over the relationship of purchasers who are being presented to a brand augmentation from a different product classification. Additionally, the point of this study is to add to the information of how buyers react to the expansion products, by examining the impact of the parent brand.

1.2 Objectives of the Study

To determine the impact of brand affect, brand trust, and brand image on brand loyalty.

To determine the impact of brand affect, brand trust, and brand image on customer brand extension attitude.

To determine the impact of brand loyalty on consumers' brand extension attitudes.

1.3 Research Question

The main question of this research is to find out, "What is the effect of extended brands on customers buying decision process?"

1.4 Significance Of The Study

Through the results of this research main aim is to build up a clear picture about how brand image, brand trust, and brand affect impacts on the brand extension attitude while having an eye on brand loyalty in the biscuit industry. The study will create a significant effect on the organizational

level strategies that are planning to take in the future in the said context.

2. LITERATURE REVIEW

Brand image is the present point of view of the customer with respect to the brand. It tends to be described as a strong bond of relationship inside the psyches of the target customer groups. It shows the real reason what the brands stand for. It is the course of action of a set of beliefs that has with respect to a specific brand and it is the client's acknowledgment about a brand. It is the manner by which a specific brand is arranged in the market. Brand image additionally passes an emotional value and not only a psychological image (Abdullah, 2015). Brand image definition that is generally acknowledged in the literature defines this term as the recognition about a brand reflected as affiliations existing in the memory of the buyer (Martínez & Pina, 2003).

It defines the relationship between consumer and brand under certain classes and it tends to be considered as the general evaluation of the consumer towards the brands. As such consumer emotional reaction towards a brand is the result of having an experience with the brand. As indicated by discoveries of past authors they said brands are a tool for the customer to take pictures and sentiments in their mind. And while including a brand expansion, a view of the organization all things considered. The diverse brands make a distinctive image in the mind of the consumer which makes it easy to identify distinguish competing brands (Alavinasab et al., 2017).

Simply brand extension is using the established and existing brand name of one product line to bring another product category to the market(Alavinasab et al., 2017). As per the extraordinary brand, augmentation methodology is the place

the expansion is helped by using the image and name of the parent brand. anyway, an inconceivable brand expansion further fortifies the name and image of a parent brand (Jiang et al., 2002). The framework of consumer brand augmentation likewise chains the prospect of brand expansion by educating that brand expansion impact the viewpoint toward the all-inclusive brand of a buyer positively. The fruitful brand extension relies upon the consumer's view of fit or similitude within the new expansion and the parent brand.

Brand trust is a standout amongst the most profitable intangible resources in business. However, in the business condition trust can be elusive and brands must work hard to maintain and look after it. To achieve the said goal brands must be dependable, capable, and convey their guarantees. Factors, for example, use (or indeed, misuse) of consumer information mean trust will develop in significance for brands and buyers (Anwar et al., 2015). The most essential quality that you have to create as a component of your brand strategy is consumer trust in your brand image promise. At the end of the day, consumers need to believe that your image will convey its guarantee in each connection, or they'll get some distance from your image looking for one that meets their desires and conveys on its guarantee over and over.

Brand loyalty is a purchaser's tendency to buy a particular brand from a range of brands in any situation. It occurs because of the offering of the right product features, to a favorable level of value at the correct cost. This positive recognition of the brand by the customer results in a repeat buying behavior of the same brand achieving faithfulness towards the brand.

Loyal customers are those who hold a favorable attitude towards the firm committed to making a purchase again a product or service and also recommend and suggest the product to other people

based on 3 approaches, behavioral, attitudinal, and composite measurements (Bowen & Chen, 2001).

2.1 Conceptual Framework
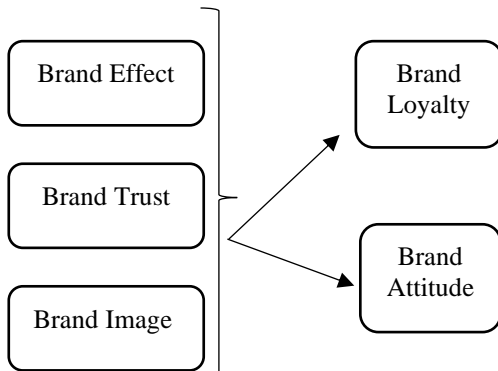
H_{1a}:Brand affect has an impact on brand loyalty.

H_{1b}:Brand trust has an impact on brand loyalty.

H_{1c}:Brand image has an impact on brand loyalty.

H_{2a}:Brand affect has an impact on customer attitude.

H_{2b}:Brand trust has an impact on customer attitude.

H_{2c}:Brand image has an impact on customer attitude.

H_3: Brand loyalty has an impact on customer attitude.

3. RESEARCH DESIGN

This research will be carried out based on quantitative data. The source of data for this study is an empirical survey. A structured questionnaire will be used to collect data from the target group of the population. This structured questionnaire will be composed based on six different sections There are a variety of methods considered to form the basis for research, but the key concern is the category of data desired. For the current study which involves quantitative data collection, researchers used a questionnaire as the data collection instrument.

The current study is limited to the Colombo District of Sri Lanka, and the geographical area of Sri Jayewardenepura Kotte. Sri Jayewardenepura Kotte, the administrative capital of Sri Lanka which is in the Colombo District was selected as it represents a diverse and heterogeneous population and different social strata, and as well as convenience of the research.

Statistical Package for the Social Science (SPSS) version 21 was used to investigate data and to find the conclusion. To identify the positive nature and negative nature of the relationship, the correlation was used as a tool to find the connection between a dependent variable and an independent variable. Objective one and two were tested utilizing Multiple Regression and a Linear Regression test was used to measure the third objective.

4. FINDINGS AND DISCUSSION

The total sample size was 200 respondents, which consisted of 82 males and 118 females. In the structured questionnaire, the first question was about the four products (Munchee Kome, Munchee Burbon, Munchee Potato Cracker, and Munchee Lemon Puff) to

find out the experience of respondents on these four products. The second question was about the gender variation (male and female) and the third question was about the age category of the respondent

Table 1 - Gender and Variation

		Lemon Puff	Bourbon	Potato Rice Cracker	Kome
Gender	Male	31%	25.5%	23.5%	17.5%
	Female	50.5%	44%	38.5%	34.5%
Age Group	18-25	53.5%	49.5%	44.5%	36.5%
	26-30	11.5%	11.5%	11%	8.5%
	31-45	11.5%	5.5%	4.5%	5%
	Above 45	5%	2%	2%	2.5%

According to the age categories, it shows that there is 66 percent of respondents belong to the age group of 18-25 years, 14 percent of respondents in the 26-30

group, 13 percent of respondents among 31- 45 group, and only 7 percent of respondents belong to the above 45 years of age group. According to the age categories, the above table shows that most of the female and male respondents from age among 18-25 (53.5%) belong to Munchee Lemon Puff product and the least number ofrespondents (36.5%) belong to Munchee Kome product.

4.1 Normality Analysis

Before conducting further statistical tests, data should be tested to find out the normality of data.

Table 2 - Normality test results

		Kolmogorov-Smirnova			Shapiro-Wilk		
		Statistic	Df	Sig.	Statistic	Df	Sig.
BL and CA	Male	.097	82	0.054	0.976	82	0.131
	Female	0.090	118	0.020	0.969	118	0.008

The significance (Sig.) of the Shapiro-Wilk Test is greater than 0.05 for both the Male and Female groups. Data is considered to be normal when Shapiro-Wilk Test shows a value greater than 0.05, the data is normal

4.2 Reliability Analysis

The consistency, stability, or dependability of the data is measured through Reliability Analysis. Reliability

can be measured using Cronbach's Alpha test and is designed to measure the internal consistency of questionnaire items. Cronbach's Alpha value of .964 (for 33 items) indicated a value more than 0.7. According to Carmines, and Zeller (1979) the value should be above 0.7. Hence, the test indicated evidence to support the strong reliability and consistency

4.3 Validity

The authors also estimated discriminant validity to further ensure the adequacy of the measures. As all the Average Variance Extracted (AVE) values were higher than the threshold value of 0.5, convergent validity was supported (Hair et al., 2014). Discriminant validity was further evaluated by comparing the square root of the AVE of each construct with the bivariate correlations among constructs (Table 3). Composite Reliability (CR) values were higher than 0.7, therefore, construct reliability was further supported

	CR	AVE	BA	BT	BI	BL	CA
BA	0.895	0.682	0.870ᵃ				
BT	0.914	0.728	0.166	0.826			
BI	0.901	0.652	0.377	0.248	0.853ᵃ		
BL	0.973	0.877	0.377	0.377		0.808ᵃ	
CA	0.934	0.578	0.450	0.404	0.408	0.614	0.937ᵃ

a Square root of AVE in the diagonal

4.4 Hypothesis testing

To estimate the fitness of the model estimates including the χ^2 statistic, the goodness of fit index (GFI), root mean square error of approximation (RMSEA), comparative fit index (CFI) and Standardized Root Mean Squared Residual (SRMR) were assessed using AMOS and SPSS. The model yielded acceptable fit indices: $\chi^2/df = 2.357$, GFI = 0.951, RMSEA = 0.045, CFI = 0.960, and SRMR =0. 0384. In addition to this, the mediating effect of brand loyalty was tested using PROCESS macro developed by Hayes, and Scharkow (2013).

Hypotheses		Estimates	CR	p-value	Comment
Code	Path				
H1a	BA -> BL	0.225	5.549	***	Supported
H1a	BT -> BL	0.238	6.571	***	Supported
H1c	BI ->	0.215	3.41	***	Supported
H2a	BA -> CA	0.124	6.459	***	Supported
H2b	BT -> CA	0.348	8.781	***	Supported
H2c	BI -> CA	0.161	4.811	***	Supported
H3	BL -> CA	0.521	6.321	***	Supported

*** is significant at 0.05.

The above table shows a positive relationship between brand affect and customer attitude, brand trust and customer attitude, brand image, and customer attitude as the CR value is 6.459, 8.781, and 4.811 (> 1.96) respectively and all significant at 0.05. Hence its can be seen that there is a positive relationship between among the study constructs supporting H2a, H2b and H2c.According to results it shows a positive relationship between Brand loyalty and Customer attitude as the CR value is 6.321 and its significant at 0.05.

H4a depicts that brand loyalty mediates the effect of BL on CA. The indirect relationship between BA and CA was significant (indirect effect = 0.24 95% bootstrap CI from 0.32 to 0.58). The direct effect of BA on CA was also significant (direct effect=0.18 95% bootstrap CI from 0.10 to 0.18) suggesting that brand loyalty partially mediates the relationship between BA and CA. Besides, H4b suggests that brand loyalty mediates the effect of BT on CA. The indirect relationship between BT and CA was significant (indirect effect = 0.32 95% bootstrap CI from 0.17 to 0.34). The direct effect of BT on CA is also significant (direct effect=0.20 95% bootstrap CI from 0.05 to 0.13) suggesting that brand loyalty partially mediates the relationship between BT and CA. H4c depicts that perceived loyalty mediates the effect of BI on CA. The indirect relationship between BI and CA was significant (indirect effect = 0.48 95% bootstrap CI from 0.28 to 0.37). The direct effect of BI on CA was also significant (direct effect=0.24 95% bootstrap CI from 0.08 to 0.17) suggesting that brand loyalty partially mediates the relationship between BI and CA.

5. DISCUSSION AND CONCLUSION

The findings of the study revealed that Munchee Lemon Puff is the most experienced product among all age categories of male and female respondents and among all four products. The least experienced product is the Munchee Kome product.

As shown in the previous chapter correlation analysis indicated that there is a correlation under the significant level of 0.01 Alpha values. The relationships between independent variables and dependent variables show that there is a highly positive relationship between the variables.

The second correlation was tested between brand affect, brand trust, brand image, and customer attitude. From that calculation, researchers found that there is a highly positive correlation between dependent and independent variables.

The third correlation was tested between the independent variable (brand loyalty) and the dependent variable (customer attitude). Researchers found that there is a highly positive correlation between the variables.

6.   RECOMMENDATIONS

This study confirms previous research findings with high accuracy at 0.01 Alpha levels. It is recommended that a study with a more diversified sample representing all types of customers will provide more insights. The current study was limited to the Homagama town in Colombo District. It is recommended to carry out future research representing all segments and different areas. Change of customers' perception towards a brand may be affected by various other things, and actual reasons behind Brand Loyalty and Customer Attitude should be further investigated. Extending the scope of the research covering a few different brands,

it is recommended Comprehensive research study is required to compare results.

Limitation

There were certain limitations associated with this study that need to be addressed. Researchers have to take only the famous Biscuits products because many consumers are not aware of the newly introduced products and that was a big problem when we were collecting data from the consumers. Not only that when researchers are distributing the questionnaire, but many supermarket customers also had a language problem and it was a big issue to find knowledgeable customers. Sometimes the non-serious attitude of respondents are directly affected when researchers were entering data to SPSS and time constrain was become a difficult task for the researchers to conduct the study throughout the whole island and hence the study was limited only to the Colombo district. Since there are thirteen cities in the Colombo district, researchers had to narrow it down to two cities to conduct the study.

Furthermore, the researchers had to limit the sample size to 200, even though the researchers expected to collect data from 300 respondents. This is because the researchers had a limited timeframe.

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Use of Blockchain for E-Voting system

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ABSTRACT

Blockchain technology is gaining popularity in the past several years. It implementation ensures the ability to tackle the various challenges in different fields, including voting, finance, health care, and many more. Democratic voting process is an important and serious process in every country. The popular method for nations to vote is conventional paper voting and electronic ballot systems, Here in Sri Lanka the election is a dominant process which contributes with large amount of money and wastage of time as well as this process consists of major corruption and frauds. The Electronic Voting system is a voting system in which the voting process is recorded, copied, stored, and processed digital, allowing voting management activities easier than the traditional paper-based approach. Blockchain offers new opportunities to develop new types of applications. It provides authentication, anonymity, integrity, transparency, and accuracy. In this research Use of blockchain for E-Voting systems and reduce the cost of the traditional ballot system will discuss and compare.

Keywords: Block chain, E-voting System, Traceability, Authentication, Security, Election, Smart Contract, Privacy, Digital Voting, Digital Features, Hashing.

RDIS: Web Application to Detect Rubber Manufacturing Process Defects

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ABSTRACT

The rubber manufacturing industry plays an important role in the Sri Lankan economy. And it is one of Sri Lanka's five main subsectors by GVA (Gross Value Added). It is contributing in various ways to the growth of the economy of Sri Lanka. In Sri Lanka as a country, they are manufacturing top-quality ribbed smoked sheets(rss)within the minimum cost range. But, the rubber product manufacturing process, commonly faced various challenges. Rss related problems are one of the major challenges that occur in that manufacturing process. Due to technical limitations rss sheets can be overheated, also rss, are faced with coagulation problems. Usage of chemicals is another reason for ribbed smoked sheet-related problems. Those problems are mainly occurring reduce of grade quality. Presently, rubber sheets manufacturers are identifying rss related defects by using a version-based approach. Hence, RSS makers are facing different types of problems such as rss buyers are not giving proper prices, buyers nominating invalid grades, etc. For such a problems minimization, a Proper rss defect identification system is essential for the industry. As minimizing those problems, a web application called RDIS has been designed. The rubber sector workforce (processors, graders, buyers, other rubber product manufacturers) can easily use this web application and they can get their sheets defects by wasting minimum time. The system (RDIS) is mainly developed by using image processing techniques. During the implementation in the model development phase, have various steps. The steps are to collect data from the rubber research institute located in Ratmalana, Crop images by using python, create a dataset, Color images convert into wavelet format, classify images by using their color frequencies, and model training by using a neural network. The model will train only to identify two defects namely reeper marks and mould growth. Displaying results for defects, created the Html based web interface. As the result, image processing by using frequency-based classification and neural network-related model training can be the most suitable way to detect defects.

Keywords: RSS, Wavelet, Neural Network, Web Application

Smart Hospital Ward Monitoring and Management System Through Use of Secured-IoT Network for Current and Future Pandemics.

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ABSTRACT

Pandemic situations are one kind of disruptor to the normal style of life which compel changes to policies, procedures, and functions of any discipline. Social distancing is a key takeaway to manage such situations especially as a countermeasure by the authorities. Especially for the professionals in the healthcare domain, they perceive high risk in exposure to these health vulnerabilities. Internet of Things (IoT) with a proven track of excellence plays a vital role as a supporter of academic and industrial activities, especially in healthcare. With the incorporation of advanced innovations for the healthcare domain, the efficiency in diagnosing, medication, monitoring, and management has been easier than conventional methods. There are specific community requirements in this type of pandemics, especially in handling risky patients; tracking, monitoring, and getting real-time data. The perspective of this paper is to review and explore the role of IoT in hospital ward monitoring and management as a lead to offer a practical healthcare solution for the Sri Lankan domain with the significance of working on a pandemic situation with great affordability.

Keywords: Internet of things, pandemics, COVID-19, healthcare, smart buildings, smart cities, industrial IoT, smart hospital

A Web-Based Early Risk Prediction Tool for Cardiovascular Disease

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ABSTRACT

Cardiovascular disease (CVD) is one of the leading causes of mortality around the world. The Sri Lankan community is also facing a major dilemma as the number of fatalities from cardiovascular disease rises. Due to multiple flaws identified and inadequate knowledge about this disease, traditional diagnosis procedures are prone to erroneous results. As a significant portion of individuals who are at risk are not correctly diagnosed as cardiac patients, the probability of producing precise results is slim. Another prevailing concern leading to the growth in CVD-related mortality in developing countries like Sri Lanka is the shortage of medical personnel with the requisite training and skills. The goal of this study is to discover the flaws in traditional CVD diagnosis practices, as well as to assess, comprehend existing systems and the contributing risk factors of cardiovascular disease. Especially, it investigates how to incorporate artificial intelligence to predict the risk of CVD and also to enhance the performance of existing classifiers to provide an efficient early risk prediction for CVD. The Cleveland, Statlog, and Framingham datasets were used to test both conventional machine learning models (i.e., Logistic Regression, Naive Bayes, Random Forest, and Support Vector Classifier) and deep learning models (i.e., Deep Neural Networks and Long Short-Term Memory networks). Three home datasets were produced by modifying existing datasets to enhance usability. A stacked ensemble model integrating numerous heterogeneous classifiers was devised to increase the accuracy of weak classifiers. Stack machine learning and stack deep learning, two stacked ensemble models introduced in this research, are effective in enhancing the prediction accuracy of anomalistic classifiers. Stack machine learning models outperformed anemic classifiers by 84%, 78.6 %, and 82.7% for the Cleveland, Statlog, and Framingham datasets, respectively. Stack deep learning models surpassed feeble deep learning classifiers by 84.7%, 83%, and 81% for the Cleveland, Statlog, and Framingham datasets, respectively. The increased performance of the suggested ensemble learning approach is further validated by the Receiver Operating Characteristic (ROC) curves and confusion matrices. As the conclusion of the study, a web-based early risk prediction tool for cardiovascular disease was developed, incorporating the high-performing models.

Key Words: Cardiovascular disease, Artificial Intelligence, Deep Learning Models, Stack Machine Learning Mode

E–Arm Robotic Medical Diagnosis Arm

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ABSTRACT

The E-Arm is considered to be one of the very innovative ideas came up into the Sri Lankan health system which has not been in the practice for it past few centuries in use. Therefore, this E-Arm system which integrates the nurses the doctors as well as the patients into single platform in order to improve the efficiency and effectiveness through the functions of a hospital by direct communication to the communication between the doctors and nurses in relevant to the targeted patients. whereas this E-Arm is consisting with a robotic arm which would diagnose the temperature and heart rate of a patient and inform it to the doctor and nurse if is identified in unusual behavior. therefore, similarly this entire system is consisting with mobile application and closer to come toward the usage with Internet of Things. this system is one of the most important requirements needed and treating of patients who are highly contagious due to conflict infected disease, or a communicable disease and this E-Arm can get and treat the patients in a way that would make less force and more productivity. so, this E-Arm is a technology which is using Arduino, Android Application, Cloud Database (Firebase Database), Latest SDK, Bluetooth, Wi-Fi to achieve the success though. so finally, this system can be declared as one of the very most important requirements in the health sector what we are in what we really understand do it demand in this flight situation.

Keywords: Bluetooth module, Wi-Fi Module, Robot arm, Internet of things, Servo Motor, Mobile Application, Body temperature, Heart rate sensor

Smart Hospital Ward Monitoring and Management System Through Use of Secured-IoT Network for Current and Future Pandemics.

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ABSTRACT

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Keywords: Internet of things, pandemics, COVID-19, healthcare, smart buildings, smart cities, industrial IoT, smart hospital

Personalized Medicine for Achieving Sustainable Development Goals: A Systematic Literature Review

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ABSTRACT

As a result of the rapid progression of the research and development in STEM, Personalized Medicine (PM) has been in the works of modern health settings. However, due to the novelty of PM, its sustainability metrics in global context requires further study. PM provides a holistic approach to healthcare, considering not limited to symptoms, but also individual's genetic composition, anthropology and ecological factors. The purpose of this systematic literature review is to discern and appreciate existing literature focusing on the connections between PM and Sustainable Development Goals (SDGs), announced by the UN agreed in 2015 among all 193 member countries. It has been shown that the SDG3: Good Health and Well-Being contributes the most to the SDG index of a country, and also the most significant contributor towards improving other SDGs. Furthermore, this review explores the timely spaces of effective implementation of health policies through multidisciplinary approaches and the potential caveats during such policy execution. For our literature search using several index repositories and snowballing, ("personalized medicine" OR "precision medicine") AND ("sustainable development goals" OR "SDGs") AND ("sustainability" OR "sustainable development") was considered as the search string, and seven publications from 2016 - 2021 were considered. Through this systematic literature review, we hope to demonstrate how PM could be utilized for achieving SDGs.

Keywords: Personalized medicine, SDGs, Sustainability, Sustainable Development, Sustainable Development Goals

Use of Blockchain for E-Voting System

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ABSTRACT

Blockchain technology is gaining popularity in the past several years. It implementation ensures the ability to tackle the various challenges in different fields, including voting, finance, health care, and many more. Democratic voting process is an important and serious process in every country. The popular method for nations to vote is conventional paper voting and electronic ballot systems, Here in Sri Lanka the election is a dominant process which contributes with large amount of money and wastage of time as well as this process consists of major corruption and frauds. The Electronic Voting system is a voting system in which the voting process is recorded, copied, stored, and processed digital, allowing voting management activities easier than the traditional paper- based approach. Blockchain offers new opportunities to develop new types of applications. It provides authentication, anonymity, integrity, transparency, and accuracy. In this research Use of blockchain for E-Voting systems and reduce the cost of the traditional ballot system will discuss and compare.

Keywords: Block chain, E-voting System, Traceability, Authentication, Security, Election, Smart Contract, Privacy, Digital Voting, Digital Features, Hashing.

Smart Farm for Agriculture

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ABSTRACT

Global livestock farm management is rapidly changing in response to globalization and growing demand to reduce the utilization of human resources to step forward with smart farming management. At present, people tend to use IoT to bring this sector of livestock management into a smart and convenient industry by using many new technological features.

When it comes to Sri Lanka, automated technology has not touched the farming sector. Farms in Sri Lanka can be categorized into livestock farming and agricultural farming. Livestock farms are maintained manually using human forces, and only a few types of machinery are used. Also, the security level of these farms is not concerned by the farmers. So, they face many security issues such as loss of animals, entry of unknowns. The farmers are less concerned about animal health conditions. Smart farm research project is focused on identify existing problems in livestock farm management and provide a solution by using new technologies.

Researchers develop the "Smart Farm" software product focuses on livestock farming using IoT technologies. Also, the mobile app that built can control and manage livestock farms including user management, communication management, shift management, issue management, and controller management. The physical model farm that was created, indicates the capabilities of this project and demonstrates four key areas of cleaning unit, food feeding unit, water controlling unit and gate controlling unit. All the controllers can be easily handled through the Smart Farm mobile app

Key Words: Livestock management, IoT, Smart Farm, Mobile app

Energy Policy Transitions & Sustainable Innovations for Revitalizing The Indian Economy

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ABSTRACT

India is on a rapid growth trajectory supported by its diverse demographic, technological intelligence and innovation ecosystem. It boasts of a 1.3 billion strong population, a GDP of 3 trillion USD, and ranks 48th on the global innovation index. The growth of this scale has a major impact on the use of natural resources and carbon emissions, and India is the third- largest emitter of greenhouse gases, behind China and United States. In 2021, India accounted for 3 giga tonnes of carbon or 6.8% of the total global emissions. For a vast nation like India, it is key to harmonize economic development with sustainable environmental development. The government has continuously strengthened the nation's commitment to renewable energy sources by setting up institutions as well as by formulating policies for solar, wind and alternate fuel sources. This paper is a study of the numerous shifts in the energy policy of India from fossil dependent to a producer and consumer of renewable energy sources; and how these shifts are impacting the sustainable innovations.

The research is done through extensive literature review, abstraction of qualitative data, insights using secondary data sources and data analysis. The author critically examines the relevant Indian institutions, schemes and policy initiatives to create sustainable development through alternative

energy sources. The paper also sheds light on the sustainable innovations. The paper concludes with a focus on the innovation ecosystem setup and its impact on the Indian economy, and how this change can be leveraged to revitalize the economy.

Key words- *Renewable energy, Innovation, Sustainable, Economy, India*

Sinhala Sign Language Translation using Transfer using Transfer Learning

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ABSTRACT

The automated interpretation of sign language is a challenging task to proceed, the sign recognitions required high level computer vision and the high level motion capturing and motion processing system to generate more accurate results in image perception. In previous years there was a number of research done for the communication between deaf and mute people with the society in the international context. ASL, ISL, and other sign language translation to proper text or voice from different technologies. In this study focus on the Sri Lankan Sign Language translation and making effective communication between the deaf and mute people and the society. After studying the previous technologies which focus on machine learning image classification and identification, get the successful point as well as the failures done in this research.In this thesis, the author used machine learning and transfer learning to make a system which is capable of translating Sinhala Signs into text. The model consists of the implementation of a pre-trained MobileNetV2 model. The created model relies on the transfer learning during the training of model and data. The research has specifically recognized 5 sinhala signs. The model was hosted on a platform and the users can use it with the web application interface which provides all the input of images as well as provide real time sign translations. The TensorFlow JS based hosted model creates json as output for the web application user end. Users can translate the Sinhala Signs real time which is more useful in the effective communication between the people who are using the Sinhala sign language for their communication. The system is capable enough for work in any kind of system which is performing heterogeneous behaviour in the context.

Keywords : Sinhala Sign Language, CNN, Transfer Learning, Tensorflow Framework, OpenCV, SSD, Image processing

Gadget Doctor

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ABSTRACT

This research describes a Gadget Doctor (Vehicle Maintenance Support System) in which car owners can register their cars and receive updated maintenance suggestions from industry experts as a very close personal assistance. Currently in the world there is no system to assist car owners to maintain their vehicles. There are very few systems developed like Vehicle Maintenance Assistant Systems. But all those current systems are only for collect fuel expenses and for keep a log about your car. There are thousands of Vehicle Owners and Vehicles in whole over the globe. This research describes a vehicle maintenance support system that helps vehicle owners maintain their cars. This system has been developed with the knowledge of experts in the industry. Gadget Doctor can use the Gadget Expert System to collect modern technology and the latest vehicle issues. If there are any problems with our recommendations, Vehicle owners can discuss those things in the linked Gadget Forum. That is why this project is not like another traditional assistance system. Because this project can give all assistance for maintenance.

Gadget Automobile Market is another Very useful interconnected platform that helps Vehicle owners to find their Spare Parts and services they want. As a feature we can suggest that spare parts in Gadget Doctor Dashboard according to their upcoming issues. So users can find spare parts in one click from Gadget Doctor Dashboard. REST-APIs have been used to connect all those platforms. Gadget Mobile app is also an interconnected mobile app with Gadget Doctor Dashboard. With this app Gadget Doctor can keep in touch with users. Using this we can send Notifications for the Service Reminders and Vehicle Maintenance Issues. That's why mobile apps are very useful for the Gadget Doctor Project. This research discusses Gadget Doctor's technology stack and basic architecture and discusses what improvements can be made to make it more effective. An interactive web application, a forum, a marketplace, an expert platform, and a mobile app will be generated at the end of the project as interconnected products.

Keywords: Vehicle maintenance Support System, Automobile, Mobile Application

Bogus IOT intruder Detection system

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ABSTRACT

In this modern age, there is an increasing amount of IOT device used in almost every corner of the world. Even though these devices are smarter, users will have a chance of falling into the vulnerabilities and the insecurities of these devices. With these vulnerabilities, threat agents like intruders will take this opportunity to exploit and to cause unnecessary harm to the victim in many ways as possible. One way of causing a harm to a victim is by using a programmed IOT devices technology to connect to the Victims network to launch an attack without the user's knowing about it. With such an attack, factors such as privacy and security of the user will be exploited, and certain actions will have to implemented to avoid such threats to the user. To connect to the victim's network, usually the threat agent will use an IOT device to establish a connection in the network and the intruder device will try to maintain itself as an authorized device within the network. So, to avoid the threat, it would be efficient to monitor the devices in the network and to detect the intruder device on time without having to face any consequences. Therefore, with my "Bogus IOT detection system" project, I will be able to help users to scan their network and to detect any intruder IOT device that might have been connected to the network to cause harm to the victim users in various unimaginable ways.

Keywords: IOT, Intruder, Privacy, Safety, Detection, Python programming

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Using ICT to Give Reliable Information About Suitable Cultivation for Lands

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ABSTRACT

Sri Lanka is an agricultural country blessed with all the environmental factors to grow many varieties of crops. Agriculture is the backbone of Sri Lankan economy since ancient times. Therefore, developing agriculture is important to uplift the Sri Lankan economy and the standards of living. As an agricultural country, approximately 25% of the population of Sri Lanka which is a significant percentage engage in agriculture. But the productivity of agriculture is not visible, and statistics show that the contribution of agriculture to the national Gross Domestic Product (GDP) is nearly 7.9% which is a very low figure compared to the population engage in agriculture. Though there are various reason for this imbalance, one of the main reasons is not cultivating the correct crop at the correct place and time, as the success of cultivation depends on the harvest and also the market for each crop. Therefore, being aware the harvest and the market is important before starting the cultivation. For this reliable information should be available. And also, information should be easily accessible. ICT can be used to manage and share this information among cultivators. This study is an attempt to show the importance of being aware of and having proper knowledge prior to starting cultivations. In this research and project, a solution is proposed to help cultivators to select the best crops considering environment factors and the market. It is expected that this e-agriculture concept would increase the contribution of agriculture to the Sri Lankan economy.

Key words: E agriculture, GDP, Harvest, Market, Climate, Crop suggesting system

Traffic Guard: Mobile Traffic Controlling System.

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ABSTRACT

Traffic Guard is a system that has always been a prominent need in the Sri Lankan road traffic system. This system exercises its functions to improve the management of the local road system with respect to pedestrians, police, and drivers.

Especially Sri Lanka has a legit method of deducting demerit points from the drivers who violate the road rules in different potentials but there is no practical method of enforcement therefore this system effectively achieves that task through a mobile application, furthermore traffic guard system provides vital services such as displaying black listed or a stolen vehicle to the police and simultaneously general public can notify the relevant authorities via the system and all the physically performed tasks are automated by generating E-Fines.

In particular, Sri Lanka has a legitimate method of deducting demerit points from drivers who violate road rules in various potentials, but there is no practical method of enforcement; thus, this system
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effectively achieves that task through a mobile application. Furthermore, the traffic guard system provides vital services such as displaying black-listed or stolen vehicles to the police, while simultaneously notifying the relevant authorities. (Proofread Paragraph)

The application allows police officers to scan and identify text on the documents through the Google vision API. It also uses GPS and location services (Google Maps API) to get the current location when a fine is generated. A payment gateway is used to allow the public to pay their fines using the mobile app (Razor Pay). And this system reaches to its users (police and public) on two platforms as a mobile application and a web application (police department). Finally, this system can be denoted as a timely requirement to address the ages old impractical traffic system of Sri Lanka.

Keywords: Traffic Guard, android app, web app, character recognition, google maps, online payment, E-Fines

Booking Time: Restaurant Table Reservation

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ABSTRACT

Booking time is an application that is used to reserve the tables at restaurants. It consists of a mobile application and a web application. Usually, people used to visit the needed restaurant and check the availability of the tables. By using this application, people can go through the needed restaurant and reserve a table. The purpose of this application is to help people to save their valuable time. The need to do this application was highlighted by the answers of the survey that was conducted. After observing the survey, the need for this application was highly recommended by the people who are highly busy with their work. By using this application, users can check the details of the restaurants whenever they want. They can reserve their table while staying at any place. The employers of a specific restaurant can manage their restaurant page. It's a simple application as it is used by every category of society. User-friendliness is the main factor in this application. Table reservation applications are very rare in Sri Lanka. But in other countries, they are used to using this kind of applications. So, it will be a new start for the people in Sri Lanka.

Keywords: Reservation, Restaurant, Web application, Mobile application, User-friendliness

Wide-Awake: A drowsy Driver Detection System.

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ABSTRACT

The number of accidents caused has increased rapidly over the past few years. According to recent researches, many of these accidents are caused by drowsy driving. At present, in response to this situation, certain types of drowsy driver-identifying systems have been introduced to the world. However, due to some of the technical loopholes of such existing systems, the functionalities of those systems are questionable. With these considerations in mind, Wide-Awake, The Drowsy Driver Detection System has been developed to answer these shortcomings. Through this system, a drowsy driver will be immediately identified, and actions will be taken to bring the driver back to a normal alert state within seconds. The concepts of computer vision and image processing were mainly used in the development of this Wide-Awake system. The system consists of three components: a neural network-based component, a mobile application, and a web application. The concepts of deep learning, machine learning, python, and Keras were used to develop the core component of the system. The Android framework was used to develop the mobile application with the Google vision API. Finally, Flask micro web framework, OpenCV libraries, HTML, and CSS were used to develop the third component, the Web application. The Wide-Awake system plays a vital role as a high-quality system that enhances the quality of human life and provides greater security for human lives.

Keywords: Drowsy driver detection, Computer vision, Image processing, Deep learning, Artificial neural networks, Mobile application development, Web application development

Mobile Application: Centralized Platform for Road Maintenance Issues

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ABSTRACT

My city is consisting of a mobile application and a web application. From this system, people can report road maintenance issues. A huge problem regarding road maintenance can be seen in every area in Sri Lanka. The purpose of this study is to develop a centralized platform to report road maintenance issues and reduce road traffic and maintain the standard of roads in Sri Lanka. So, to know the real situation of this problem the survey which is done to was very helpful. By the survey analysis, the likelihood of having this application and the desire of of having this kind of application was shown by the feedback. The mobile application provides the facility to retrieve the nearby issues based on their postal address, report issues and upload photos. The web application provides the facility to report the related issues to UC and the issues are shown to the UC and the RDA. After that, the RDA can assign the work by analyzing the issue. The RDA can observe the status of the work that has been assigned. RDA workers can get the information of the assigned work and report the status of the work assigned. These are the main facilities that are provided by this application.

Keywords: Road Maintenance, Issues, Centralized platform, Mobile application, Web application

Agro Management System

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ABSTRACT

The E-Argo management system is a time-consuming requirement for the Sri Lankan agriculture industry. Where the request offers a facility for farmers in agricultural fields to market their harvests without the intervention of any broker, and where they can receive single profits without any waste. In addition, in order to capture the retail demand, this application would enable farmers to have their harvest in the e-market. The advantage of this application is that the E-Argo management system encloses all physically fulfilled operations in the agricultural sector in Sri Lanka into a single epicenter and digitalized for simple use by Lankan farmers, and this is the first and foremost application in this area to come up with a creative solution to resolve the key and forgotten problems facing farmers and with the aid of the farmers. so, this Agro is a technology which is using. Android Application, Online Database (Firebase Database), Latest SDK,Web application. To achieve the accomplishment, however. Finally, what we truly understand is what this device demands in this flight situation can be proclaimed as one of the most significant criteria in the agricultural field.

Keywords: Intermediator, Database, Agricultural machinery, Mobile Application, Web Application, Post-harvest, E market

A Study on Economic and Social Success Of Women Machinists: The Case Study of Garment Factories In Katunayake Free Trade Zone, Sri Lanka.

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ABSTRACT

Sri Lanka has several Free Trade Zones (FTZ), which contain different manufacturing operations including garment factories. Though the garment industry contributes heavily to earning foreign currency for the economy society has a mindset that the women in garment factories come from rural villages with an intention to achieve success in their lives but end up with an unsuccessful life. Though the perception is that it may not be true. Thus, this research addresses the issue "Have the women machinists in garment factories in Katunayake FTZ have achieved economic and social success in life?" The study taken seven women machinists who have worked more than one year in the Katunayake FTZ are as the sample and semi structured interviews have been used as the data collection technique. Accordingly, the study found the following. Most importantly, with their stable monthly income women workers have experienced economic independence and autonomy in making decisions within the family. Thus, they have utilized their earnings to ensure wellbeing of their families, especially children as well as of the parents. Further, they have experienced social mobility as they have been warmly welcomed by the villagers on their return to home which they did not experience before being employed. With the above findings it can be concluded that women machinists have achieved economic and social success in their lives as a result of being employed in garment factories in FTZ's.

Keywords: women machinists, women labour, garment industry, economic and social success

Secure Text

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ABSTRACT

Security is an essential factor in day-to-day activities. In the field of computing, security is a major component as it is the factor that decides the confidentiality and the integrity of the data which could be much sensitive. In the current social security of data and information is not in a good state as many people do not care about the security of the data and think about the coincidence which could happen if the security is breached. Online examination is the new trend which is being practiced in Sri Lanka. In here this examination method is more convincing than the traditional examination.

As due to the CVOID – 19 pandemic examinations are shift from the traditionally to online examination. This method ensures that the health and safety guidelines which are used in pandemic situation will be observed. But due to the online examination there are some vulnerabilities where one could explore and make this examination to be unsuccessful.

Mainly the paper could be among the public before its used in the examination in many various ways such as phishing attack, data breaching etc. As for the paper where it is transport in a removable hard disk this could be a major opportunity where anyone access the paper as if this removable hard could be misplaced or stolen. In here this research begins with the survey of identifying the weaknesses of the online examination. In hereby observations and other methods, the information was gathered. Here it was identified that the papers which are in PDF format are sent in a traditional way where anyone who has a somewhat knowledge could breach the paper and take it.The research's main objective is that to secure the online examination paper procedure and to ensure that both examiners and the participants of the examination that the paper is secure, and the confidentiality and the integrity of the examination are safeguarded to the maximum.

Secure Text is an application which is having the objective of making sure that the paper/file which is transferred to be secured from the start point to the endpoint. Here the paper will be encrypted (is the process of encoding the information in such a way that only authorized parties can access) using the exe file Secure text which the code is known by only the start point authorized personality and endpoint personality. The encrypted paper will be transferred by any means of the method and in the endpoint, it will be decrypted (is the process of decoding the information which was encrypted) by using the same key which was used to encrypt the document.By Secure text, its main goal will be to make sure a secure data transfer happens between the locations where the paper is being transferred and the integrity and confidentially of the examination paper will be protected.As the system is implemented the author has some development plans for the system.Currently "Secure text" is running on a DES algorithm-based encryption algorithm that is strong but there are many other stronger algorithms that could be used. So, the author's main priority in the future of the "Secure text" is to implement the AES algorithm together with the DES algorithm which means it will be having double encryption for more secure transfer. "Secure text" has its database, which is implemented currently, but the author plans

to connect the system to the centralized database which any organization has. This means that the system is under that central database where the administrator of the database could monitor the logins for the system and detect any unauthorized logins to the system. Here if this condition is applied the registry option in the system will be removed and its database would be there as a backup in case if the centralized database fails.Next, the system's access control could be improved by adding two-way authentication system, which means when a user login to the system he/she shall get a code to the phone number which is required to continue further in the login and with that code, he/she shall be able to complete the login.The author is currently under researching the title "How to use geolocation to unlock the system". If this condition could be applied to the system via location the system would be much secure as the parameter is given that the system will not encrypt or decrypt the file if the user is not within the location. All plans which are mentioned to the system are to improve its main function as to increase security in file transfer and its access control to stop unauthorized users to access the system.This system could be used in the examination department of Sri Lanka as this secures the paper and makes sures that the confidentiality and security of the paper remains. Secure text's main advantage would be that this software would make sure that the paper would remain confident until its being decrypted by the invigilator. This software is on a low budget where for security the cost could be minimized. As a developing country Sri Lanka could use Secure Text not only for examination department but also in other department where it requires a safe pass of a secure electronic documents. As explained in above this system requires a very minimum requirements where this is possible it implement almost anywhere around Sri Lanka.As for the conclusion Author could say that Secure Text could be an answer for the question of what the security in online examination as this is could make the online examination to be secure and to make sure that

online examinations would be the next level in examinations.

Key Words – Encryption, Decryption, Secret Key, Examination paper, secure transport.

Sustainable Smart Waste Management System

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ABSTRACT

This is an era where technology is predominating every aspect of the world, competitive market on economic world is widening to a greater scale resulting significant achievements to mankind and simultaneously creating much more chaotic conditions in terms with nature and its elements by humans. Especially waste management has become a major issue worldwide from developed nations to developing nations. Therefore, Sri Lankan waste management can be considered as an important social need.Will Clean is a system that enables the Sri Lankan waste management strategy to step into a sustainable approach via modern technology, this system reaches to the Most importantly Will Clean will systematically segregate Degradable and Non – Degradable waste into two segments within the system for the convenience of the users, by letting the residents (Users) to sell their Non – Degradable waste to the Waste buyers via the mobile application under distinct categories such as, Plastic, glass, metal and significantly the E – Waste. Resulting an E – Platform for the users to sell their waste which had been dumped in unhealthy manner for past decades causing many environmental issues. Furthermore, this system allows the residents to communicate with their relevant governing authority to have an efficient track on collecting non-Degradable waste by building a connection between the mobile and web applications. Finally, Will Clean will establish sustainability, efficiency and environmental conversation with economical enhancement in the local society to address wider issues such as global climate change, household economy and public hygiene and Will Clean can be deemed as a timely need for the current society. Furthermore, **Wil Clean** can be presented as one of the very innovative solutions to a major problem that can be considered as a threat to mankind, that is none other than global waste management issue, which has triggered numerous socio-economic and health problems locally and globally. This global hazard can be addressed by the local initiative of Will clean as it is a Smart Waste Management System that enables efficient management of waste in a systematic approach and its importance can be deemed as "With rapid increase in population, the issues related to sanitation with respect to garbage management are degrading immensely. It creates unhygienic conditions for the citizens in the nearby surrounding, leading to the spread of infectious diseases and illness. To avoid this problem, **IoT based** "**Smart Waste Management**" is the best and trending solution.Moreover, Will Clean is functioning in two different approaches to degradable waste and non-degradable waste as it is expanding its functions to the upliftment of domestic economy by creating a portal for any user to engage in a non-degradable waste market for selling and buying them, simultaneously this project enforces a systematic governance over degradable waste collection to recycling. Importantly, Will Clean directly involves in the battle against Climate Change by working on reducing the accumulation of non-degradable waste into nature from urban, sub-urban and rural human habitats in Sri Lanka. Furthermore, Will Clean Smart Waste Management System endorse the Sustainable Development Goals of United Nations (SDG – UN) by empowering key factors. Finally, will clean can be introduced as a timely

need for the 21ˢᵗ Century as a sustainable and lively tool for a good living standard to global citizens.

***Keywords- Smart waste management, Degradable, Technolog*y**

Real-Time Face Mask Detection System

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ABSTRACT

Due to this ongoing Coronavirus pandemic, millions of people have been infected as well as millions of lives have been lost. Due to this reason, it is vital that we take necessary precautions to not only avoid getting infected, but also to avoid spreading the virus among other people. While there are multiple ways to reduce the probability of getting infected, the most practical solution of them all is to wear a face mask that covers the main entry points for the virus which are the nose and the mouth. Therefore, this project can be helpful to remind people to wear a face mask before entering a building or a public area. By using this system, it eliminates the need to physically have a person standing at the entrance to remind the people that are entering to wear a face mask. With the use of face detection, OpenCV, Tensorflow, Keras libraries and other technologies, this project can help detect if a person is wearing a face mask, not wearing a face mask or even if they are wearing the face mask correctly to cover both their nose and mouth. This automated system can be further developed and used in public transportation systems such as busses, trains and airplanes too.

Keywords: Face detection, Face mask, Real-time, OpenCV, Tensorflow, Keras.

Data Science for Sustainable Development: A Systematic Literature Review

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ABSTRACT

Sustainable Development goals (SDGs) agreed in 2015 by all 193 member states are expected to convert the world into a more sustainable one. These goals provide a solution to sustainability issues with regard to nations' economies, the natural environments and the societies. Unfortunately, it has not shown satisfactory progression. It has now become a challenge to achieve SDGs by 2030. Therefore, it is of paramount importance to identify synergetic goals which has a high positive and low negative impact on other goals' attainment when improved (Pincet, Okabe, & Pawelczyk, 2019). A SDGs consists of an expanding list of 231 unique indicators. However, the SDG Index has been introduced to measure the progress of each country's performance on SDGs (Sachs, Schmidt-Traub, Kroll, Lafortune, & Fuller, 2016). It has been shown that contributions of all SDGs to form the SDG index, not all of them have relative or equal importance. Using machine learning, the order of importance was shown to be SDG3, ''Good health and well-being''(42%), SDG4, ''Quality education''(24.8%), SDG7, ''Affordable and clean energy''(8.6%), SDG9, ''Industry, Innovation and Infrastructure ''(5.1%) followed by other SDGs (Atie Asadikia, Abbas Rajabifard, Mohsen Kalantari, 2021). This systematic literature review intends to cover SDG4 (24.8%) and SDG9 (5.1%) which in turns amounts to almost 30% of the individual contributions of SDGs to SDG index. Furthermore, relative or equal importance of SDGs are shown to vary with the level of the country. The countries with above average SDG index, SDG4 (2.53%) and SDG9 (10.69%) amounts to a total of only 13%, whereas the other countries amounts to SDG4 (34.33%) and SDG9 (8.96%) giving a total of 43%. In a quantitative time-series analysis which investigated the correlation among SDGs indicators, SDG3 has ranked as the top synergetic goal (Pradhan et al., 2017). This shows how the pandemic situation prevailing in the world adversely effects the achievement of SDGs. In this study, it is shown that interactions occur between SDG9, ''Industry, innovation and infrastructure'', and SDG4. Identification of synergetic goals and correlations among SDGs paves the way to allocate resources which make it possible to achieve of those goals and boost the SDG index of the country significantly.

Key words – Sustainable development, data science, education, industry innovation

Automatic Number Plate Recognition System (ANPR) For Parking

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ABSTRACT

Automatic number plate recognition system (ANPR) for parking lots is a security solution for a problem people face at present. It's simply a system designed to read the number plate of a vehicle at the moment that it enters a certain parking lot and at the moment that it left the parking lot. So, the aim of this project is to create an automatic system for the existing manual system with higher accuracy and efficiency. Hence, there will be no need of a worker for that job. So, the objective is to develop an automatic license number plate detection and recognition system that can identify all the vehicle license numbers and maintain a record with the time of the arrival and departure of the vehicles along with the driver details. So that information can be used in an emergency as well as for data mining. A camera is used to get the inputs and a computer is used to recognize the numbers using machine learning. Later the identified vehicle license numbers will be saved with the time of arrival and departure of the vehicle.

Keywords - ANPR, Python, Image processing, Parking lots

Smart Digital Agri Bridge: Connect Sri Lankan Farmers with Public

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ABSTRACT

In Sri Lanka The integration of Information Technology with agriculture should be identify and establish it as an important for achieve agriculture related sustainable development process. Main objective of this research is to suggest more suitable and proper approach to connect the Sri Lankan farmers with public. The desire of those who are unable to cultivate in their own backyard to cultivate and to provide what they need directly through a farmer. In response to these needs the **Smart digital Agri bridge** was initiated as entry criteria for the main objective. The proposed system is included hire a farmer for selecting relevant public by crop category and District. After select and hire a farmer, both can connect with each other by using IOT technology. The system will provide task monitoring, weather updates, Temperature details, soil moisture levels etc. Also, this research including win-win concept and Zero hunger concepts. Both Registered users can get more profits and donate extra cultivation by using this system. This agreeable work to latest innovation with traditional farmer's cultivating practices would help in expanding the harvest productivity and assist the farmers with benefitting financially. This would improve work on the nation's economy.

Keywords - Information technology, Farmers, Smart digital Agri bridge, IOT technology

A Network Model to Detect the Digital Manipulation in Document Images

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ABSTRACT

Digital images usage has rapid growth with increase of internet usage, digital document images are commonly used for sharing information or as submission as proof of information in online systems. This project focuses on developing a deep neural network model to detect the digital manipulation in document images that can be deployed on mobile and edge devices. The proposed model is based on semantic segmentation and modified to use two encoder blocks with one block taking noise generated image as input. Noise is generated utilizing the steganalysis rich model filter layer which creates local noise distribution to extract features from noise inconsistency from manipulated regions of the image. In this project the model is trained on a dataset created using splicing and copy-move digital image manipulation techniques. The authentic images are based on the PubLayNet document image dataset. The model is converted into edge device compatible format so it can run prediction on 32-bit processor systems and doesn't require a high performance compute device connection.

Keywords - Encoder blocks, PubLayNet

Pests in the Coconut Cultivation Industry: An IT-Based Solution for Pest Detection in the Coconut Cultivation Industry

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ABSTRACT

Coconut cultivation industry plays a pivotal role in Sri Lanka. It involves many industries such as desiccated coconut, coconut water and coconut oil etc. So many peoples' lives depend on this cultivation. Although year by year, we can see a decline in coconut production. Main reason for this unfortunate state is mainly pests. If coconut cultivator is able to identify relevant pest in early stage, it is easy to prevent spreading before it becomes worsen by spreading to the whole coconut plantation. But the main challenge is the identification of pests correctly and applying suitable remedies for them. Sometimes it is hard for coconut cultivated farmers to contact and get instructions from relevant officers to eradicate pests that arise in coconut cultivation because of telecommunication problems and those officers also have to cover a big area. It is not an easy job for them as well. Cultivators cannot identify the specific pest, so they cannot make appropriate remedy and some of them do not aware of it in any means. Due to the covid19 situation, this problem became worsened. To overcome these problems and challenges, decided to introduce an IT-based solution to identify pests with relevant remedy solutions.The selected algorithm was Mask RCNN for the development of the project. Dataset was collected by available images in the internet. There were three pest categories of images with 152 images from each category. Those images were then subjected to a bounding box and mask labeling method and some pre-processing steps. This developed pest detection system is capable of identifying three most harmful pests present in Sri Lanka with high accuracy. Another special feature is, it has the capability of identifying many pests present in any image with a uniform or complex background. And also, one of the pests among the three selected pests is very small, so the system is capable of identifying that small pest accurately as well. Most importantly the system is giving remedy solutions for the identified pest. Those features represent the research gap that was absent in many existing systems. The outcome of this project will help coconut cultivators and who are interested in coconut cultivation to enhance their productivity by minimizing pests and by making them aware of those problems and relevant solutions.

Keywords - Coconut cultivation industry, Telecommunication, Algorithm

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