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PREFACE

This research paper collection is the edited versions of the supervised theses of the undergraduates of the Department of Accountancy & Finance. Nearly 100 theses are supervised by the academics of the Department annually, and six papers were selected from each supervisor for the current volume. Therefore, all the papers considered in this volume are jointly authored by the final-year students and the respective supervisors of the Department. What primarily motivated me to begin this edited research series is to inculcate research culture among the academics and the students of the Department. Secondly, to disseminate intellectual knowledge to a wide spectrum of audiences, in turn, it contributes to the advancement of the body of knowledge in the field. The premise of all papers included in the volume is in the discipline of finance which covers the Capital Market, Banking Sector, and Insurance Sectors.

All the papers in this volume address timely important and academically relevant research issues. So that readers will be well-equipped with objectively addressed and scientifically supported conclusions. As such, I believe this collection will be immensely benefit the corporate sector and government policy makers. Moreover, this will be a useful work for students, teachers, researchers as well as other public-spirited citizens who are interested in this subject discipline. Also, I personally, witnessed the extent of work done by all the academic authors in bringing undergraduate theses up to the standard demanded by academia. I congratulate all the academics for encouraging the students to contribute papers for this publication.

As the initiator of this idea, I first compiled the concept paper for the Faculty Board and the University Senate. The comments given by the members of both bodies to further shape the idea are highly appreciated. Very importantly, I must appreciate all the academic members of the Department of Accountancy & Finance for encouraging me to proceed with my innovative idea and giving their fullest corporation to bring the idea to a reality. My Co-authors' intellectual and expert contribution is also commendable. Finally, I also appreciate the efforts of the editorial assistants and the copy editor of this edited book.

D.A.I. Dayaratne, PhD
Professor in Finance
Editor-in-Chief

CONTENT

CHAPTER ONE

Influence of Artificial Intelligence Applications on Banks' Sustainability during COVID-19 Pandemic: A Case Study in Sampath Bank PLC

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Abstract

Presently, the entire world is dealing with a massive manmade health disaster of the COVID-19 pandemic which had an immediate impact on the entire world. The traditional banking system has undergone a rapid conversion due to stay-at-home legislation. As a result, every bank is currently experiencing crisis management issues, including employee and client limits due to social distance and quarantine measures. Artificial Intelligence (AI) aids bank operations in various ways to deal with these consequences. The way those financial activities are being redefined and changed by digital transformation. AI is the most recent notion in the commercial world to help businesses succeed. It is improving the long-term sustainability of banks all across the world. The primary objective of this research is to understand why new-normal banking practices need to enhance AI implementation to manage the adverse impact of future health crises like COVID-19. This study purposefully used Sampath Bank PLC to conduct single case study. A qualitative research approach was used to address the research questions and objectives, and semi-structured interviews were used to collect primary data from five employees. This study used thematic analysis approaches to analyze the primary data and triangulation for secondary data to gain deeper insights. The results finally discovered the importance of AI technologies on banks' sustainability during a crisis.

Keywords: *Artificial Intelligence, COVID-19, Sustainability.*

1. Introduction

The COVID-19 pandemic dominates the entire world. This massive pandemic has drastically impacted the economic and social activities of the whole world since the end of 2019. The national social isolation, quarantine, and lockdown actions have impacted all sectors and had unimaginable social and economic effects, putting unprecedented and multi-dimensional

strain on stock markets, enterprises, the health sector, societies, and individuals. Millions of employees were moved to work from home, and thousands lost their jobs without notice. Mainly in developing countries, such as Sri Lanka, many people lost their city jobs and have been forced to return to their rural hometowns to escape poverty. World Bank estimated that more than 150 million people were pushed back into poverty due to this pandemic. Financial systems are the central division that was hit hard by the COVID disaster.

Any crisis will first push their finance into credit risk, increasing the probability of a liquidity crisis (Kaya, 2019). The COVID-19 pandemic, viewed as one of the most severe worldwide crises, has significantly impacted the global financial sector (Narayan, 2020). Especially at the beginning stage, banks were paralyzed and failed to function their day-to-day operations in the usual way. In addition, every bank faced crisis management challenges, such as a lack of staff due to social distancing and quarantine measures. Moreover, it has to deal with an increase in calls to its call centres, which have been understaffed and overburdened at a time when customers are in urgent need of reassurance. However, to keep the economy stable, banks must carry out smooth operations in any way they can. Digital Financial Inclusions (DFI) help various bank operations to deal with those consequences. Digital implementations benefited the banking industry in overcoming COVID-19 and assisting banks in maintaining their stability. Although banks have been using digital financial solutions for many years, they do not recognize their value as much as they know now. The global banking business has adopted technological developments like open banking, platform banking, electronic onboarding, cryptocurrencies, blockchain, artificial intelligence (AI), and big data analytics.

Artificial Intelligence (AI) is one of the advanced technologies that has recently become a ground-breaking concept that humans surpassed. Simply, AI is a programmed software that can reflect like humans and it includes the capability of thinking, planning, solving problems, processing information, comprehending complex ideas, learning quickly, and learning from experience, among many other things. AI concept has been adopted in various sectors; the banking sector has taken the first place. According to the Central Bank of Sri Lanka, the advanced technologies like Artificial Intelligence, Robot treatments, big data, 3D printing, and blockchain technology are emphasized as the fourth industrial revolution (Central bank, 2019). Most Sri Lankan banks are looking to expand their access by investing in digital creativities to maintain a competitive margin by offering a more comprehensive range of products and services. In the Sri Lankan context, the best example is Sampath bank; the pioneer introducing AI technologies to the entire banking sector in Sri Lanka. They introduced the first transactional humanoid teller banking robot (Barrimi et al., 2013) and also, Sampath bank is currently the highest technological adapting bank in Sri Lanka.

During the COVID period, AI accelerated dramatically to combat the situation (Khan et al., 2021). Before COVID, some banks were enthusiastic adopters of AI, including machine learning and other advanced data science techniques. Global banks, mainly in developed countries, adopted these newest technologies before the COVID pandemic and earned benefits through those implementations. Nevertheless, Sri Lankan banks were not well prepared for such a pandemic. The AI applications pre-COVID adopters could combat this pandemic successfully. Therefore, AI technology is a sidekick for banks' sustainability during the COVID pandemic.

Accordingly, the rest of this paper is organized as follows. Section 2 outlines the research problem with justification, and rationalizes the research questions and objectives. Section 3 states the theoretical background and summary of existing empirical studies. Section 4 highlights the methodological requirements of the study. Section 5 summarises the data analysis and discussion. Finally, section 6 provides the conclusion of the study.

Recently, human beings have experienced the fundamental importance of advanced technologies. The reason is the COVID-19 pandemic. It was a serious challenge faced by the banks besides. They were forced to find new solutions and quick fixes to overcome the challenges encountered due to the COVID pandemic. As the economic fallout spreads, banks find themselves juggling some big priorities that require concrete steps to reposition now while also recalibrating for the future. The most prominent solution was the advanced technological applications. Thus, digital transformation is redefining and changing the way of the whole banking industry. AI technology takes primary place. In Sri Lanka, most banks that adopted AI applications before the pandemic beat pandemic pressure firmly. That helped the banks' sustainability even after the pandemic period. The central research problem based on the aim of this study is to identify why new-normal banking practices in Sri Lanka need to improve Artificial Intelligence implementation to combat the future crisis. As such, the following research questions are developed to substantiate the issue presented under the problem of this study.

- What are the current applications of AI in Sampath bank practices?
- What are the distinct advantages of using AI applications in Sampath bank?
- How do AI applications assist in overcoming the COVID-19 pandemic challenge?
- Why are AI applications essential to Banks' sustainability during crises like the COVID-19 pandemic?

The study will aim to enhance the following objectives,

- To examine the exising applications of AI in Sampath bank

- To understand the benefits of using AI applications in the Sampath bank
- To examine how AI applications support overcoming the COVID-19 challenges to Sampath bank PLC
- To examine how AI applications assist in the sustaninability of Sampath Bank PLC during the COVID-19 period

In addition, many researchers have done many studies regarding various technological advantages. However, they were not identified precisely how AI technologies are helpful to the banks to beat the pandemic crisis like the COVID pandemic.

2. Previous Literature

Since the COVID pandemic is ongoing, the researcher needs to consider the situation of the COVID pandemic. This study will be the first study on banks' AI applications during the COVID situation. Plenty of research has been studied regarding digital transformation and its impact on banks' sustainability (Khan et al., 2021; Kaur et al., 2019; Fernandez, 2019; Onainor, 2019). According to the past literature, very few studies on AI have been conducted in relation to the banking system (Kaur et al., 2020; Goudarzi et al., 2002; Vijai, 2019). Nevertheless, few studies have examined AI's benefits, challenges, and risks in the banking industry and its usage in fraud detection and performance evaluation. Most empirical studies focus on FinTech and are published globally (Omreng & Gjendem, 2017). When considering the Sri Lankan context, very little research has been done on the new technological concept relating to the banking sector. The following section reviews the related theoretical and empirical literature on AI applications in banks during the COVID pandemic and the impact of banks' sustainability causes of COVID.

This study identified two main related theoretical approaches. These theoretical models were selected by focusing on the organizational level. When the bank or any organization needs to adopt any innovative applications or want to implement new advanced technological methods, they have to consider related theoretical features. This study discusses two main related theoretical models; Diffusion of Innovation (DOI) and Technology-organization environment (TOE). AI assists the banking industry in providing excellent customer service, and as a result, many new banks are adopting new technologies such as AI, cloud, and square chain. The banking industry utilises AI in a novel method that saves energy and cost. The entire banking world has smoothly done its operations through computers and networks, which is possible because banks use AI (Onainor, 2019). The impact of AI on India's top commercial banks was examined by Vijai (2019). Accordingly, it explored the potential and obstacles in the banking industry as they relate to AI applications. As such, all banking business segments

noticed a favourable computerized growth. Machine learning and deep learning are two types of AI that can reduce errors caused by emotional and psychological aspects.

One of AI's most significant tasks is to extract essential information from a large amount of data and make conclusions. Banks generally deal with a vast number of data and information. Thus, the features of AI technology provide tremendous service to banks. Jewandah (2018) emphasized the ways in how AI was changing the banking sector in the Indian context revealed that banks still far from the AI revolution stage, and the human touch is still crucial in Indian banking system. Further, it states that the Indian banking sector is exploring AI to improve bank operations and customer services near future. The majority of the banks use AI for automation, analysis, and decision-making, thereby creating a new business model. Khan et al (2021) emphasized that AI applications would command how banks will interact with their customers in the future. Boston Consulting Group (BCG) has studied AI technology usage in China. It results that in 2027, 23% of the job market in finance will have changed with AI. They also revealed that this new technology would reduce employment in China (He et al., 2018). One of the most prominent contemporary banking trends is shifting toward integrating big data, AI and cutting-edge technology to obtain a competitive advantage in such a difficult time (Kaur et al., 2019). There is much pressure from the government and the public for banks to take on more responsibilities to establish a more sustainable future. During the COVID-19 pandemic, the crisis forced banks to implement and improve advanced digital banking services.

After the review, it is evidenced that the literature on the nexus between AI applications on banking practices appears limited. Therefore, the researcher has identified a vacuum in this area in the Sri Lankan context. Moreover, previous studies have been done using a quantitative approach. However, the present study is conducted through a qualitative approach using the thematic analysis technique. The COVID-19 pandemic is the newest global situation and this has not previously been used for research studies in technological concepts. Thus, there is an empirical and methodological gap between previous research and the current situation. Therefore, this study attempts to fill the gap by investigating the influence of AI applications on Banks' sustainability during the COVID-19 pandemic period.

3. Methodology

This study investigates the influence of AI applications on banks' sustainability during the COVID-19 pandemic. Sampath Bank PLC was used as a case study to conduct this research since case study research is particularly well suited to investigating a current phenomenon in its natural setting (Jaehrling et al., 2018). The reason to select Sampath Bank PLC was that

they are the pioneer in introducing AI applications to the entire banking system. Simultaneously, they are also the highest technological adapting bank in Sri Lanka (Maragaoda, 2019).

Table 1: Participants Details (P1 to P3 are expert employees in the IT department in Sampath Bank PLC and interviewed through phone calls for the pseudonym codes. E4 and E5 are the same in the IT department who interviewed through E-mail.)

Participant	Designation	Experience
P1	Executive Officer – IT Department	10 Year
P2	Analytical Officer – IT Department	6 Years
P3	Product Developer – IT Department	5 Years
E4	Product Developer (Junior) - IT Department	4 Years
E5	Network Engineer – IT Department	11 Years

This study used a qualitative research approach to collect primary and secondary data. Primary data was collected from semi-structured interviews, and secondary data was collected through triangulation. According to Onwuegbuzie et al (2009), the ideal size of the sample frame for interviews is 6 to 12 people. However, in the case study, 3 to 5 respondents were sufficient to gather data because of the same context and experiences (Heale & Twycross, 2018). According to the Department of Census and Statistics (2020), in Sri Lanka, digital literacy is 65% in the urban area compared to the rural and estate it is the highest percentage. Furthermore, when considering province-wise, the western province is at its peak by taking 44% of the computer literacy rate. Therefore, data collecting was set to take place in the western province. This study purposefully selected five experts in Information Technology (IT) department at Sampath Bank's Head Office, which is situated in Colombo district. The interviews were conducted using telephone and E-mail techniques per participants' requests.

The Thematic analysis technique was used to analyze the primary data. The thematic analysis involves five steps. Transcribing, data coding, developing themes, analyzing themes, and drafting a report. The researcher designed interview questions based on four sub-topics. To design the themes, the researcher referred to the six phases of the thematic analysis process (Clarke & Braun, 2013).

4. Results and Discussion

The primary objective of this research was to understand "why new-normal banking practices need to implement AI applications to combat the future crisis. Apart from that, this study

required to understand the usage and benefits of AI applications. Moreover, the need to examine the impact of AI on Sri Lankan banks' sustainability during the COVID pandemic and verify whether AI applications in Sri Lankan banking practices were sufficient or insufficient to overcome such uncertainties. Finally, it aimed to suggest why AI applications are essential to Sri Lankan banks' sustainability in future obstructions. According to the data analysis, nine themes were derived in this study *(Table)*.

Table 2: Derived Themes

Research Objective	Research Questions	Themes
To examine the exising applications of AI in Sampath bank	What are the current applications of AI in Sampath bank practices?	• Pioneer and Finest User. • Diversity of AI applications.
To understand the benefits of using AI applications in the Sampath bank.	What are the distinct advantages of using AI applications in Sampath bank?	• Efficient and Effective • Customer Satisfaction and Risk Management • Competitive Advantage
To examine how AI applications support overcoming the COVID-19 challenges to Sampath bank PLC	How do AI applications assist in overcoming the COVID-19 pandemic challenge?	• Severe Deviations • Technological Aids
To examine how AI applications assist in the sustaninability of Sampath Bank PLC during the COVID-19 period	Why are AI applications essential to Banks' sustainability during crises like the COVID-19 pandemic?	• Inadequate and Unsatisfactory • Protection and Precautions

Objective One: To examine the exising applications of AI in Sampath Bank

Under the research topic, influence of AI applications on banks' sustainability during the Covid Pandemic, the first research objective was designed to study the various applications of AI in Sampath banking practices. According to the data analysis results, two themes were derived as Pioneer and Diversity of AI applications.

Theme one: Pioneer and Finest User

The analysis revealed that Sampath bank is the pioneer in adopting the AI application. Respondent believed that Sampath bank is the most refined user of AI applications in the Sri Lankan banking context. Being a pioneer, it has enhanced its reputation, and employees believe that is the major strength of the bank.

> *"I can surely say that Sampath bank is the only bank using this much of technological products" (P3)*

Theme Two: Diversity of AI applications

The researcher wanted to be aware of the various AI applications used in Sampath bank. The participants had sufficient information about the AI applications within Sampath bank.

"Sampath Wepay; messengers the future of digital payments, allowing customers to get on board via a Sampath Bank account, credit card or any other bank credit or debit card to do all bill payments, third-party money transfers, QR-based merchant payments.. "(E4).

"……. Newest one is Banking Robot, Wepay functioning as smart wallet, Sampath Instant Loan, Our Vishwa Online Banking, Slip-less Banking, Cash Deposit Kiosk, Cardless- Cash and Cheque Deposit ATM" (P3).

Further emphasized that AI can be used in various forms like minor software. The network machines and the software can implement AI and use it as an application.

"This AI can be used in a smaller way also. I mean small software to our day-to-day functions. Some of them are in the middle office, like CRM activities, some are at the Front office, like robots and security systems. Some of them are in the back office. Especially we are providing customer services like Sampath Vishwa, Wepay, POS mobile banking, Loans facilities using AI applications"(P1).

Banking Robot

This is the first robot machine used in the Sri Lankan banking system, which Sampath bank has implemented "The Banking Robot is a machine that uses artificial intelligence to recognize vocal requests and carry out the appropriate transactions" (E4). It is performed by detecting the customers by the Robot machine, which then starts a conversation. The robot can function by withdrawing cash, account balance inquiries, and providing information on exchange rates, interest rates, loans, credit cards, and how to open an account (Omreng & Gjendem, 2017).

Digital wallet – Sampath WePay

Digital wallets are regarded as the future of real-world payment systems, with major companies such as Google, Apple, and Paypal jumping on board and establishing their payment gateways. This application reduces the dependency on actual cash, allowing money to reach a broader range of people (Jewandah, 2018).

"Sampath WePay is the future of digital payments, allowing clients to use their Sampath Bank account, credit card, or any other bank credit or debit card to pay bills, send money to third parties, and make QR-based merchant payments, among other things" (P1, P3, E4, E5).

AI applications for lending – Sampath Instant Loan

Sampath Instant Loan is another Sri Lankan first, offering an online real-time financing option through Sampath Bank (Barrimi et al., 2013). Through Sampath Vishwa Online Banking, users can acquire a loan in rupee terms against a current rupee fixed deposit *(P2, E4)*. These apps can also create and manage financial plans and strategies based on research into various personalized investment options, loans, rates, and fees, among other things (Ryll et al., 2020).

Slip-less Banking

Sampath Bank has achieved another first Application that uses another AI software. They have once again raised the standard for others to follow by adopting slip-less transactions. Accordingly, anyone can deposit money, and Sampath Vishwa users can perform withdrawals, receive transaction confirmation digitally via the app and email and check the history of transactions via the app *(P1, P2, P3, E4).*

Cash Deposits Kiosk

Sampath Bank Cash Deposit Kiosk is a bulk cash acceptor that accepts payments online. Anyone who deposits funds into a Sampath Bank account can use this innovative service. It reduces the trouble of having to wait in lines at cash registers.

Cheque Deposit ATMs

Easy Cheque Deposit ATMs are poised to revolutionize cheque deposits, eliminating the trouble and saving valuable time by allowing customers to deposit checks at any time of the day and receive a complete receipt immediately.

> *"Even if it's after business hours, you can deposit Cheques. Cheques do not have to be deposited in sealed envelopes. Deposited cheques are scanned and processed immediately using the standard clearing procedure" (E4)*.

The depositor will receive a receipt and a scanned image of each deposited cheque for their records. In addition, some other general applications namely, Sampath missed call banking, and Point of Sale (POS) mobile banking are also used by Sampath Bank PLC. All these applications are monitored and executed by AI software on the banker side.

> *"Don't get confused exactly AI is not only something like big robots or bigger machines. Small little chip also can include this AI softwares. So that also included to AI application" (P2).*

Objective Two: To understand the benefits of using AI applications in the Sampath bank context.

This objective is designed to verify the second question of the study. AI-powered solutions are becoming an increasingly important aspect of banking business development strategies by helping to stay competitive in the market. AI enables banks to operate more efficiently and effectively. Banks can generally cut costs, mitigate risk, and boost revenue by implementing new technology like analytics, bots, RPA, and report generation (Deokar & Darekar, 2020). As a result of primary data analysis, three themes emerged; Efficient and Effective, Customer Satisfaction and Risk Management, and Cost and Time Value.

Theme Three: Efficient and Effective

Efficiency and effectiveness are significant advantages of using AI applications in Sampath bank. The researcher revealed that AI could boost staff efficiency while delivering broad outcomes with fewer resources.

> *"AI can increase employees' productivity, and it gives wide results using minimum resources. And also it takes banks in the right direction…. And it helps employees to perform their own works with peace of mind. Because this kind of technology reduces the unnecessary traffic within the bank. what else, when handling the bulk data this machine learning and AI help to manage easily" (P1)*

Time and cost values can be considered as the factors that enhance efficiency and effectiveness by using AI applications in Sampath bank. Efficiency involves time. Not as much time is consumed while using AI applications. Effectiveness involves both cost and time. By using AI applications, banks provided maximum service exploitation of minimum resources.

Theme Four: Customer satisfaction and Risk Management

The analysis showed customer satisfaction and risk management as a superior advantage of using AI in Sampath bank. It exposed that by using AI applications, the banker can provide banking services as the customer expected. It will enhance customer satisfaction. The analyzed results disclose that Sampath bank focuses more on new generational customers, which is a significant reason to go with AI.

> *"To provide the best customer service, we know now the current generation is moving with fast technological things right, so they are improving more with this advanced technology. And also, they are willing to get experience with this new thing. For that*

Sampath bank wants to satisfy the expectations of the customers. The best example is the Sampath Wallet application" (P2).

According to the analysis outcome, risk management is also a significant benefit. The bank is most concerned with risk management and has a superior function in risk management. It is highly required to maintain quality and the best risk management process when handling public money. Therefore, AI applications are used as a risk management tool to aid banks' functions

"... Help to Risk Management by looking at historical data, doing risk analysis, and eliminating human errors from hand-crafted models" (P3)

To mitigate the risk and cut off operational cost, the banking sector is adopting updated technologies like AI, cloud, and blockchain (Wamba-Taguimdje et al., 2020). AI assists customers in executing their tasks, speeding up response times, accurately processing data, keeping humans informed of recent changes, and more. Therefore, all of these actions assist banks in lowering costs (Deokar & Darekar, 2020).

Theme Five: Competitive Advantage

As stated above, AI was initiated to implement AI applications in the Sri Lankan banking system. Thus, the respondents had a good and proud feeling about Sampath bank. Furthermore, they explained how they were determined to utilize Sampath AI applications.

"Sampath bank getting the competitive advantages. Not only Sampath bank, when any business is moving with technology, but they can also have this competitive advantage. I can surely say that Sampath bank is the only bank using this much of technological products" (P1)

Objective Three: To examine how AI applications assist sustaining Sampath bank during the COVID-19 crisis

Due to the COVID pandemic, the financial system is one of the most affected. In particular, Banks had to deal with much change and have gone through a lot of it. In the context of Sri Lanka, the COVID pandemic impacted the entire country in many ways. The financial system has a significant role in the development of developing countries (Fernandez, 2019). This sub-objective exposed two themes; Severe deviations, New technological aids.

Theme Six: Severe Deviation

During the COVID pandemic situation, the whole world faced a severe deviation. However, this theme has been created to reveal banking function deviation during the COVID

pandemic. The analysis shaowed that the banks have changed their day-to-day activities due to the pandemic.

> *"Minimum branches opened, little staff worked, Restrictions and governance have daily put some restrictions, and we had to act under that. So it was very difficult to continuously do activities. And banks faced to credit risk due to non-performing loans, investment got stopped. So COVID impacted in many ways to the banks" (P2)(E4).*

Furthermore, they stated that banking institutions face many operational challenges, including significant loan impairment losses, credit origination and risk management, digital customer connections and flexible commercial models, operational efficiency and business continuity management, and finance and liquidity.

Theme Seven: New Technological Aids

According to the data analyzed, Sampath bank has modernized new technological aids to overcome the adverse effect of the pandemic. They have used existing AI applications more efficiently and developed existing technologies used by AI software. Those new technological aids have directed Sampath bank toward a new normal during the pandemic.

> *"Even in the situation of minimal staff, AI applications helped to reduce the impact of that. Customers used mobile apps which used this AI software and fulfilled their needs. Example Vishwa online, Wepay, Instant Loan likewise" (P2).*

Touchless Cash Withdrawals

Eliminating the need to touch the ATM's surface physically is expected to reduce danger and improve consumer safety, making it a perfect way to withdraw cash from ATMs amid the current global COVID-19 outbreak. By using this, customers of Sampath Bank and all other banks in the country can now use the Sampath WePay app to withdraw cash from their accounts and cards at any Sampath Bank ATM around the island by simply scanning the QR code displayed on the ATM screen. This application was also first introduced by Sampath bank. The researcher personally visits to check this application.

> *"Sampath Bank newly introduced Touchless cash withdrawals method from ATM. It helped to provide safety of Coronavirus" (P3).*

Mobile Branch with Pick-Me

During the COVID pandemic, the government restricted travelling, leading to a lockdown. In such a situation, people did not have cash in hand since banking customers needed to visit

banks to make their withdrawals and struggled with having no money for consumption purposes. Nevertheless, under lockdown, it was impossible to visit their branches. Sampath bank has found a solution to aid their customers in this situation. Sampath Bank and Pick-Me ride have combined and established a mobile ATM as obligatory. When customers inform the bank they need to withdraw, bank provides Mobile ATMs through the Pick-Me service. All functions of this have been implemented using AI software. Therefore, many customers in Sampath bank did not face any inconvenience, and their loyalty has upgraded through these services.

> *"Keep connected with customers through using new technological marketing strategies. And used mobile ATMs to support the customer by combining with Pick-Me" (P1).*

Introduced Chatbot

Banks run with a minimal number of employees during a pandemic, and the workload increases under this scenario. To sort out this problem, Sampath bank introduced the Chatbot service. This is a mobile application that can be moderated at any place. If customers require any information regarding their banking activities, this chatbot can provide the solutions as requested. Many solutions have automated responsible.

Overall results revealed that the AI application assisted Sampath bank in overcoming the pandemic situation, and it also discovered how it assisted Sampath bank in facing it more efficiently.

Sub Research objective four: To understand why AI applications are essential to Sri Lankan banks' sustainability to combat future obstructions.

This objective was offered to gather opinions on why AI applications are essential to Sri Lankan banks' sustainability in facing future obstacles. These questions are directly linked with the primary objective of the study. Under this sub-research question, two themes have been identified: Inadequate and Unsatisfactory, Protection and Precautions.

Theme Eight: Inadequate and Unsatisfactory

When respondents questioned whether the current AI applications were sufficient, the answers reflected inadequate and dissatisfaction. According to their views, they think the current applications within the banking system are insufficient. Furthermore, they suggested that existing applications should be developed, and new AI technologies should be implemented in the Sri Lankan context.

"Should improve new ways to implement those technologies. And the government also should help" (P1).

"No. As an initiator of AI applications, we can see a huge gap in AI implementations with Sri Lankan Banks. Most of the banks couldn't face this crisis successfully because they were not updated with new technology (E4) (E5).

Theme Nine: Protection and Precautions

This investigation discovered that AI applications should be implemented as a precautionary tool to protect from uncertainties like the COVID crisis. During the COVID pandemic, AI applications have been used more than traditional functions. Technology was the only thing that helped to conduct banking operations,

"Always need to keep a backup plan to face such crisis. And should move with new technologies like AI" (P1).

"The lesson is we should always keep with new technology because it will be the only thing to survive and sustain the banking business. And also we should be prepared for any bad situations" (P2),(P3).

Considering the overall analysis result, current AI applications within the banking industry are insufficient. In Sampath bank, their usage is high compared to the other Sri Lanka banks. However, the IT experts at Sampath bank expressed that even their applications are not enough to overcome the negative consequences of a crisis like COVID. Thus, to mitigate the risk and impacts of a crisis, banks should enhance its AI implementations and move toward a global direction.

5. Conclusion

The primary objective of this study was "understanding why new normal banking practices need to enhance AI applications to sustain from a future crisis like the COVID pandemic". This study was conducted as a case study by selecting Sampath Bank PLC. The semi-structured interview method was used for primary data collection and triangulation was used for secondary data collection. Five employees who are experts in the IT department at Sampath bank's head office participated in the primary data collection process through Phone and E-mail platforms. The thematic analysis technique was used to summarize primary data. This study designed nine themes according to the above sub-research questions.

The major AI applications that Sampath bank uses are, Banking Robot, WePay Digital wallet app, Cash-less app, Card-less app, and Instant loan App *(P1, P2, E5).* AI enhances the

efficiency and effectiveness of both parties while doing banking activities, mitigating cost and reducing time consumption of each party (Chase, 2002). Simultaneously, AI enhances customer satisfaction, does risk management, and supplies more excellent support to the bank. During the COVID period, Sampath bank used AI in designing mobile branches combined with Pick-me rides to provide ATM service to the customers. Another application was Chatbots.

Subsequently, this study revealed that the current usage of AI applications were insufficient and inadequate. As a result of insufficient AI applications, most banks could not effectively overcome the adverse impact of COVID crisis. Meanwhile, AI technology assisted Sampath bank during the COVID. Therefore, developing existing AI applications and implementing new AI applications is essential to overcome future crises like COVID-19. Thus, according to this study's findings, Sri Lankan banks should enhance new AI applications, and regulatory authorities must provide infrastructure facilities to develop advanced technologies in the banking sector.

The study has several limitations that impact the reliability and validity of the research findings. These findings have certain limitations in terms of generalizability. The research sample does not reflect all Sampath bank branches since only the Colombo district and the head branch were included in the research sample. Therefore, attention should be paid when reasoning these research findings to other geographical areas in Sri Lanka. The most significant drawback is the small number of participants with similar career backgrounds. This study used just five respondents, limiting the generalizability of this research contribution. The researcher, however, chose not to recruit any further respondents due to time restrictions and geographical barriers.

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CHAPTER TWO

Identifying Financially Sustainable Listed Companies in Sri Lanka

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Abstract

This study aims to identify the financially sustainable listed companies on the Colombo Stock Exchange (CSE) in Sri Lanka based on the Altman Z-score model. CSE has 289 companies representing twenty-one (21) World Industrial Classification Standards (GICS) industry groups as of 30th June 2020. The sample size is limited to 191 companies representing 16 GICS industries. The Z-score has been based on the period from 2015-2019. The data for the study were obtained from annual reports. The Altman Z-score was calculated by incorporating ratios, namely, liquidity ratio, profitability ratio, leverage ratio, solvency ratio, and activity ratio. This study identifies separately sustainable companies that are close to sustainable or distressed (grey) companies and distressed companies. The result of the analysis finds sixty-seven (67) sustainable companies, fifty-seven (57) grey companies and sixty-seven (67) distressed companies out of the 191 listed companies representing 16 GICS industries excluding the Bank, Diversified Financials, Insurance, Technology hardware and Equipment and Automobile and Components Industries. This finding is essential for managers, potential investors, creditors, regulatory bodies, employees, government, and society in making the right decisions in the face of financial sustainability.

Keywords: *Altman Z-score, Colombo Stock Exchange, Distressed companies, Financial Sustainability.*

1. Introduction

The world we live in is made up with full of uncertainties and risks. Especially business has been exposed to different types of financial risk and benefits. It means firms face bankruptcy or financial sustainability. Though it is not always possible to identify that movement, financial sustainability or failure is measured in many ways. The high accuracy measurement of the Altman Z-score model is to predict the chance of bankruptcy or financial sustainability in a company (Altman, 1968). Financial sustainability is understood as the ability of public

administrations to continue now and in future policies without causing the debt to rise continuously (Bolívar, 2016). This study aims to identify financial sustainability through the Altman Z-score model in the context of Sri Lankan listed companies. Sustainability means meeting our needs without compromising the power of future generations to satisfy their own needs.

In addition to natural resources, social and economic resources are also required. Sustainability is not just environmentalism. Embedded in most definitions of sustainability, we also find concerns for social equity and economic development. By the tip of the 20th century, many of those ideas had come together to necessitate "sustainable development". The motivations behind sustainability are often complex, personal and diverse. It is unrealistic to list reasons why many individuals, groups, and communities are working towards this goal. Yet, sustainability comes down to the type of future that is been left for the subsequent generation for many people. Sustainability as a price is shared by many individuals and organizations who demonstrate this value in their policies, everyday activities and behaviours. Individuals have played a significant role in developing our current environmental and social circumstances. Together with future generations, the people of today must create solutions and adapt (HLPF 2019 Spotlight Reports, 2019). "Sustainability" is a complex term comprising three main dimensions: environmental, social, and economic categories.

Many measurements have been calculated for economic sustainability and financial sustainability. Financially sustainable business has financial solid as well as broader societal benefits. Another one is recognizing investment opportunities: considerable investment opportunities present in frameworks like the Sustainable Development Goals or the growth of the renewable energy and energy efficiency sectors, and also identifying and integrating nature risk into investment and lending decisions, supporting innovation and research, developing and maintaining strong stakeholder relationships, including beneficiaries, staff and donors, obtaining a range of types of funding, including unrestricted funds, building financial reserves, assessing and managing risks, strategically managing and financing overhead costs (Bolívar, 2016). Many financial sustainability measurements are existing in the world. They are Univariate Analysis (UA), Multiple Discriminate Analysis (MDA), etc. (Al-Manaseer & Al-Oshaibat, 2018; Altman, 2013; Jones & Hensher, 2004). This research used the Altman Z-score model to measure financial sustainability. Empirically researchers have often used the Altman Z-score model to estimate bankruptcy (Gnanaweera, 2011; Kannadhasan, 2007; Lohana, 2014; Mohammed, 2017; Nanayakkara & Azeez, 2015). Simultaneously, some empirical research used Altman Z-score model to measure the financial sustainability. Still, in

the Sri Lanka context, the Altman Z-score model is not used to estimate financial sustainability (Meher & Getaneh, 2019).

The previous literature has shown that many studies identify bankruptcy and financial sustainability predictions in different context and have found different results. Many scholars added the Altman Z-score model, and some scholars used various methods to predict bankruptcy and financial sustainability. In the Sri Lankan context, no financial sustainability analysis has been conducted for listed companies, and unfortunately, a limited number of studies were focused on this concept. However, the researcher proceeds to identify forecast financial sustainability in listed companies in Sri Lanka by utilizing the Altman Z-score model and by fulfilling this essential need and bridging the empirical and knowledge gap in the country. Thus, the study's main objective is to identify the financially sustainable listed companies in CSE by considering 2015 to 2019.

This research is intended to identify financially sustainable listed companies in Sri Lanka through the Altman Z-score model. This study helps stakeholders and enable them to assess their financial strength. Consequently, stakeholders are investors, creditors, managers, regulatory bodies, employees, government, and society. An investor is any individual or other entity (such as a firm or mutual fund) that commits capital with the expectation of receiving financial returns. Investors depend on different financial instruments to earn a rate of return and attain important financial objectives like building retirement savings, funding a school education, or merely accumulating additional wealth over time. Sustainable investing, also referred as socially responsible investing, incorporates environmental, social, and governance factors into investment decisions. Individuals who invest sustainably favour investing in companies, organizations and funds, to generate measurable social and environmental impact alongside a financial return. Investors especially focus on financially sustainable companies because they focus on the benefits of the investments.

A creditor might be a bank, supplier, or individual who has provided money, goods, or services to an organization and expects to be paid later. In other words, the corporate owes money to its creditors. Therefore, the amounts should be reported on the company's record as either a current liability or a non-current liability. Creditors expect many things from financially sustainable companies. For example, a good financial policy and capital allocation statement, sound risk management process, board effectiveness, good audit, accounting and reporting, and remuneration in the company.

Managers shape the culture of their teams and workplaces in countless ways. They need to play both an administrative and leadership role. Thus, they require various sets of skills to

achieve success. Management continues to be a viable career option. The manager is an employee who is accountable for planning, directing and overseeing the operations and financial health of a business unit, division, department, or operating unit within a company. The manager is accountable for managing and leading the work of a bunch of individuals in many instances. When managers can do their job effectively, companies will be financially sustainable.

Governments or other organizations establish regulatory bodies to oversee the functioning and fairness of economic markets and, therefore, firms that engage in financial activity. The goal of regulation is to forestall and investigate fraud, keep markets efficient and transparent, and confirm customers and clients are treated fairly and honestly. Financial sustainability will help to create rules and regulations for regulatory bodies. Regulatory bodies are the Central Bank of Sri Lanka (CBSL), the Securities and Exchange Commission of Sri Lanka (CES) and the Insurance Regulatory Commission of Sri Lanka (IRCSL). Financial sustainability will benefit employees to see a clear picture of the company and its heading in the future. The government could gain comprehensive information on financial sustainability and its variables that influence the financial sustainability of companies, good governance, and the infrastructure development.

Furthermore, financial sustainability helps society because society always gets affected or benefits from activities in the business world, i.e., social responsibility. Therefore, this research can be identified as a turning point in research regarding financial sustainability, which will enhance future researchers' interest in researching this area.

2. Theoretical and Empirical Literature

Gambler's Ruin Theory

It makes predictions concerning the growth and survival of a new business. Further, Gambler's Ruin suggests that growth rates follow a random walk but that survival depends on previous growth. Thus, growth and survival are closely related. This theory is the growth and survival of a new business is theorized by referring to a Gambler playing a game of chance. The gambler needs resources to continue playing the game that can either be derived from "wins" or their sources at startup (Coad et al., 2013). According to Coad et al. (2013), Gambler's Ruin Theory is applied, which presents growth events that occur randomly and that survival depends on the stock of accumulated resources. It makes predictions regarding both growth and survival. Although growth has a positive effect on survival and a longer-term effect, financial variables are observed to impact survival substantially.

Gambler's Ruin Theory evaluated business risk in firms and used it to develop a safety index. Moreover, it claims that in comparing actual and prediction time to failure, it identifies bankruptcies or financial distress before the exact failure date (Jayasekera, 2018). Therefore, this theory helps to evaluate financial sustainability through financial distress, and it helps to make an investment decision.

Life Cycle Theory

Life Cycle Theory is applied in business to explain the birth, growth, mutation and death process of firms. At each stage, they share financial situations (Bayai & Ikhide, 2016). It is linked with the basis for the formulation of financing, marketing, costing, survival, growth and production strategies. It allows firms to transform from small, inefficient, and unsustainable firms into significant, sustainable, and financially sustainable firms (Bayai & Ikhide, 2016). According to the life cycle theory, it helps many investors to make the right decisions in the face of a financial situation.

Lifecycle theory has unique firm life cycle characteristics of birth, growth, maturity, and decline. These characteristics affect a firm's choices, especially in situations like financial distress and, therefore, the threat of bankruptcy. However, due to these lifecycle characteristics, managers may have limited restructuring options when firms are faced with distress or financial sustainability. As a firm matures, its features, business goals, strengths and weaknesses will change, reflecting the progression through the phases of lifecycle theory. The organizations become more extensive and complex in organizational structure, the concentration of ownership becomes more dispersed, and integration increases typically. Strategic decision-making and its effectiveness will also differ in counting on the lifecycle of the firm. Mature and declining firms are less likely to require innovative, risk-taking strategies than firms in birth and growth (Koh, 2015).

Financial Sustainability

Financial sustainability refers to the capacity of financial managers to manage and monitor the expected financial benchmarks and risks over the long run (Imhanzenobe, 2020). However, the concept of financial sustainability is broader than just liquidity or short-term profit. It encompasses long-term returns, growth potential, and the ability to withstand financial distress. The financial sustainability of companies is often found within the answer to the subsequent questions; is the company profitable? Is that the company growing? Is the company operating at an acceptable financial risk level? (Imhanzenobe, 2020). According to Meher & Getaneh (2019), financial sustainability is measured through Return on Assets, Return on Equity, Financial Stability Index, and Bank Soundness. However, this research

finds out identifying financially sustainable listed companies in Sri Lanka through the Altman Z-score model because it helps to measure bankruptcy and financial sustainability.

In the late 1960s, several studies developed models for failure and financial sustainability prediction. Researchers have examined some models to identify their forecasts. There are Univariate Analyses (UA), Multiple Discriminate Analyses (MDA), etc. (Al-Manaseer & Al-Oshaibat, 2018; Altman, 1968; Jones & Hensher, 2004). According to previous research, the most related Altman Z-score model is used to measure financial sustainability under financial distress. This model was initially identified and developed in 1968 by Edward I. Altman, where he utilized data collected from large US companies. He developed a model for predicting company failure or sustainability. This model uses five financial ratios that combine a single number identified as the Altman Z-score. It measures corporate financial health and soundness (Mohammed, 2017).

Empirical Literature

The importance of the listed companies in Sri Lanka for an economy can be measured by financial sustainability through financial distress. Altman's Z-score helps to measure these things (Jayawardena, 1984; Wilkinson, 2013). Therefore, this study investigates the Altman Z-score model, which impacts financial sustainability in the listed companies in Sri Lanka. This section presents the empirical studies that highlight relevant financial distress findings that affect identifying financially sustainable listed companies through the Altman Z-score model.

Several studies have evaluated financial sustainability using several measures, both quantitative and qualitative. Most studies on financial distress also apply indirectly to financial sustainability (Wällstedt et al., 2014). Several studies that have considered the impact of profits, efficiency, liquidity and solvency ratios on financial performance and sustainability have found these variables significant.

Zorn et al. (2018), researched Swiss Dairy farms on the financial ratio impact on financial sustainability. The study related financial sustainability with profitability, liquidity, financial efficiency and solvency and two different models to reflect the differences between European and North American policies. In the North American model, profitability, liquidity efficiency, and solvency were the variables, while profitability, liquidity and solvency were the variables for the European model. They introduced seventeen (17) regularly used financial ratios and they used five (5) profitability ratios, four (4) liquidity ratios and four (4) financial efficiency ratios. In addition, four (4) solvency ratios were used, which include three (3) stability ratios and one (1) repayment capacity ratio. This study can be used to measure the financial

sustainability of Swiss Dairy farms, indicating a high correlation between the general sustainability indicator and the regional sets of indicators. By using the descriptive analysis, correlation matrix and Spearman's rank method, they found that the correlation coefficient among the selected financial ratios was significant and highly positive.

The above study is similar to Hur-Yagba et al. (2015), who assess the financial health and sustainability of wind electricity sectors in the Baltic States and manufacturing companies in Nigeria. It further recommended that companies inculcate liquidity, solvency efficiency, and profitability management policies as part of their corporate management policy framework. In addition, the Altman Z-score model for financial distress should be utilized by manufacturing companies to assist them predicting declining financial sustainability before it occurs.

The study of Tian & Yu (2017) investigated whether an international study on financial ratios as predictors of financial sustainability from the perspective of bankruptcy uses the Altman Z-score model. They determined a set of default predictor variables that represented profitability, liquidity and solvency ratios for Asian and European markets using panel data. In addition, they included that three predictor variables (Retained Earnings/Total Assets, Current Liability/Sales, and Total Debt/Total Assets) are exact predictors of bankruptcy for Asian markets (Japan). In contrast, the Equity/Total Liability ratio was determined as the significant predictor of the Altman Z-score for European markets (UK, Germany, and France).

The research of Liang et al. (2016) investigated the impact of financial ratios and corporate governance indicators on bankruptcy prediction. The study used ninety-five (95) financial ratios and ninety-five (95) corporate governance indicators for 239 bankrupt and 239 non-bankrupt Taiwan companies from 1999 to 2009. Accordingly, these financial ratios and corporate governance indicators were categorized into seven different categories of financial ratios and five categories of corporate governance indicators using discriminant analysis. The financial ratios have been better than corporate governance indicators for prediction. However, both projections give better results. The result showed that the solvency and profitability ratios combined with board structure and ownership structure provided the best combination for bankruptcy or financial sustainability prediction.

The study of Elmabrok & Kim-Soon (2013) examined using Altman's Z-score model to predict the financial hardship of firms listed in the trading services sector of Bursa Malaysia for the period 2003 to 2009. They used random and non-random profitability samples. It could be a difference in determining the financial situation between failed and successful companies; some companies listed within the non-financial failure firms listed within the

Malaysian stock market have financial difficulties. This study demonstrates that using the Altman model is the predictor of an organization's financial failure. Further, it could be an excellent tool for investors to predict the financial failure of companies.

A study by AlAli (2018) examined the application of Altman's Z-score model in determining the financial soundness of healthcare companies listed in the Kuwait stock exchange over the period 2013-2016. It was used to examine financial performance and predict the risk of bankruptcy. Although there are many Altman Z-score models for various varieties of companies, the five-factor model is used for manufacturing companies, and there is a model designed for banks. This literature uses the Altman four-factor model to measure the financial stress of the companies. In addition, this research includes a formula for non-manufacturing and emerging companies (working capital to total assets, retained earnings to total assets, earnings before interest and taxes, and total book equity to total liabilities).

The above studies examined financial sustainability or bankruptcy for foreign countries. Nevertheless, the following studies are related to Sri Lanka. The research of Gnanaweera (2011) analyzed the bankruptcy prediction in the Sri Lankan manufacturing sector using thirty-three (33) de-listed and thirty-three (33) listed companies for the period 2000 to 2010. It used four financial ratios to predict the distress conditions or bankruptcy of the de-listed companies in Sri Lanka. Altman's work has shown that the Z-score and variants have a high degree of accuracy in predicting corporate financial distress within the US, and emerging markets. According to the study results, the Z-score (1963 original model) classifies 90% of the distressed firms and 60% of the non-distressed firm accurately.

A study by Nanayakkara & Azeez (2015) predict corporate financial distress in Sri Lanka from 2002-2011. It includes independent variables such as accrual-based financial ratios, cash flow-based financial ratios and market-based variables. Dependent variables are categorical as financially distressed and financially not distressed. Moreover, multivariate discriminate analysis was used as the analytical technique and a stepwise method to identify the variables. Therefore, it can be used to assist investors, managers, and regulatory bodies in Sri Lanka.

The previous literature has shown that many studies identify bankruptcy and financial sustainability predictions in different contexts and found different results. Many scholars added the Altman Z-score model, and some scholars use various methods to predict bankruptcy and financial sustainability. It used financial ratios, macro-economic factors, return on assets, returns on equity, financial stability index, stock market index, firm size etc. (Al-Manaseer & Al-Oshaibat, 2018; Altman, 2013; Imhanzenobe, 2020; Lohana, 2014; Meher & Getaneh, 2019). In different studies, various contexts showed mixed results.

Subsequently, scholars found the best method of identifying bankrupt or financially sustainable companies by the Altman Z-score model (Wilkinson, 2013). Many research articles investigated identifying bankruptcy or financially sustainable companies through the Altman Z-score model. Further, many empirical works exist in various contexts such as Jordan, Oman, Malaysia, the UK, the USA, Kuwait, Ethiopian countries, Nigeria, India, etc. In the Sri Lankan context, no financial sustainability analysis was conducted for listed companies, and unfortunately, a limited number of studies focused on this concept. However, the researcher proceeds to identify forecast financial sustainability in listed companies in Sri Lanka by utilizing the Altman Z-score model and attempt to fulfill this essential requirement and bridge the empirical and knowledge gap in the country. Therefore, the researcher wants to fill this gap while enriching the existing literature and investigating the identifying financially sustainable listed companies in Sri Lanka through the Altman Z-score model.

3. Methodology

The methodology is based on the recent theoretical and empirical findings related to identifying the financially sustainable listed companies through the Altman Z-score model. The research question is, what types of listed companies come under the financially sustainable category? It describes the approach to test the selected Altman Z-score model according to the related objectives in the introduction part. The researcher allocates the independent variables reference with five ratios according to the previous research studies to measure financial sustainability. Five financial ratios are liquidity ratio, profitability ratio, leverage ratio, solvency ratio and activity ratio. According to the Z-scores, financially sustainable listed companies, greys listed companies, and distressed listed companies in Sri Lanka were identified. The overall framework describes the flow of the research, and accordingly, it will give the conclusion in light of the research objectives.

The relevant population of this study includes all the companies listed in CSE in Sri Lanka and actively traded in the period 2015-2019. The sample size is limited to 191 companies representing 16 GICS industries. This study excludes three industries, namely Banking, Diversified Financial and Insurance since it has distinct characteristics from its nature. Further, these industries are governed by the Central Bank of Sri Lanka and Insurance Regulatory Commission of Sri Lanka etc. The technology hardware and equipment industry had no companies, and the automobile and components industry had one company, but no data is available. Data for this study were gathered mainly from annual reports of firms and the CSE data library.

This research was based on the secondary data obtained from published sources, i.e., annual reports for five years (2015-2019). The absolute figures reported in the financial statements do not serve to measure the companies' financial sustainability. Hence, the financial analyst has to analyze the financial data to ascertain the strengths and weaknesses of the companies. Even though financial analyst have many analytical tools, ratio analysis is the most powerful tool to show the financial sustainability of companies. Alone a single ratio does not serve the purpose. The collected data was analyzed with the help of ratio analysis. The financial ratios used to predict the financial sustainability or failure of the company gives a warning only when it is too late to take corrective action. Therefore, combining the different ratios into a single measure of the probability of financial sustainability or failure is necessary. Altman's Z-score model is a helpful tool in such a situation. The use of the Altman Z-score model helps to consolidate the effect of all ratios. Keeping the above view in mind, the researchers took five years Z-score average for identifying financially sustainable, grey, and distressed listed companies in Sri Lanka. The examples are shown below.

Table 1: Example Z-score calculation and identification of sustainability

Company	Sector	Z-score					Average Z-score	Results
		2015	2016	2017	2018	2019		
Abans Electricals PLC	Consumer Durables & Apparel	2.88	2.80	2.37	2.22	1.76	2.40	Gray Company
Lanka IOC	Energy	7.17	5.78	6.83	4.20	4.79	5.76	Sustainable Company
Hunters and Company PLC	Retailing	2.26	2.60	1.99	0.83	0.72	1.68	Distress Company
ACL plastics PLC	Materials	5.01	5.69	7.98	3.13	4.76	5.31	Sustainable Company

Source: Survey Data (2019).

4. Results and Discussion

Financially Distressed Listed Companies in Sri Lanka

The analysis shows financially distressed listed companies (an average Z-Score below 1.81) from 2015 to 2019. It indicates a high probability of distress within this period. Out of the 191 listed companies, sixty-seven (67) distressed listed companies in Sri Lanka represent twelve (12) sectors, out of the sixteen (16) sectors. Commercial and professional services, household and personal products, pharmaceuticals biotechnology and life sciences, and utility sectors have not included distressed companies.

Table 2: Comparison of Safe, Gray, and Distress Companies

Sector	Safe Com.	Grey Com.	Distress Com.	Total Com.
1. Consumer Durables and Apparel	3	1	6	10
2. Healthcare Equipment and services	2	3	3	8
3. Energy	1	-	1	2
4. Commercial and Professional Services	3	2	-	5
5. Transportation	1	-	1	2
6. Food and Staples Retailing	-	2	1	3
7. Household and Personal Products	1	-	-	1
8. Pharmaceuticals and Biotechnology and Life Sciences	-	1	-	1
9. Telecommunication Services	-	1	1	2
10. Utilities	1	4	-	5
11. Retailing	4	5	2	11
12. Materials	8	7	2	17
13. Real Estate	8	6	3	17
14. Capital Goods	6	13	10	29
15. Consumer Services	14	4	16	34
16. Food, Beverage and Tobacco	15	8	21	44
Total	67	57	67	191

Source: Analysis outputs (2020).

Gray Listed Companies in Sri Lanka

The analysis shows grey-listed companies from 2015 to 2019 period. An average Z-score between 1.81 and 2.99 is in the Gray Zone, suggesting a good chance of the company going distressed or sustainable within the next two years of operations. Out of the 191 listed companies, fifty-seven (57) grey-listed companies in Sri Lanka represent thirteen (13) sectors, out of the sixteen (16) sectors. Energy, transportation, household, and personal products sectors are not included in the grey zone. Accordingly, the market prices of fourteen (14) listed companies increased and the market price decreased by forty-three (43) listed companies from 2015 to 2019.

Financially Sustainable (Safe) Listed Companies in Sri Lanka

The analysis shows the financial sustainability of listed companies from the 2015 to 2019 period alone with the Z-score. An average Z-score above 2.99 is in a safe or sustainable zone. Altman's Z-score model combines five (5) financial ratios to predict the probability of a company becoming sustainable in the next two (2) years. Accordingly, out of the 191 listed companies, sixty-seven (67) sustainable listed companies in Sri Lanka represent thirteen (13) sectors out of the sixteen (16) sectors. However, food and staples retailing, pharmaceuticals, biotechnology, life sciences, and telecommunication services sectors have not included sustainable companies.

Three (3) companies exist under sustainability in the consumer durable & apparel sector, namely, Hayles Fibre PLC, Regnis (LANKA) PLC and Teejay Lanka PLC. The average Z-scores are 3.66, 3.81 and 3.52, respectively. The market prices of Regnis PLC decreased, and other companies' market prices increased from 2015 to 2019. Based on the annual reports, the main strength or reason for sustainability is to produce innovative products in this sector. Similarly, strengths are providing environmentally friendly products, exports to many destinations, operational excellence, product development, and managing relationships. Meanwhile, qualitative characteristics are fundamental, relevance, enhancement, timeliness, and understandability.

The healthcare equipment & services sector has two (2) companies under the sustainable or safe zone. They are Asiri Surgical Hospital PLC and the Lanka Hospitals Corporation PLC. The average Z-scores are 3.89 and 6.01, respectively. According to CSE data, market prices of both companies decreased from 2015 to 2019 since companies consistently improve the quality of human life. In addition, their success in the industry has been an approach to sustainability, responsible governance, and ethical standards. Sustainability is an integral component of the hospital's business model, and they have embraced their responsibility towards people, patients, communities, and the environment.

The energy sector has one (1) company under the sustainable or safe zone. It is Lanka IOC. An average Z-score is 5.76, and the market price decreased from 2015 to 2019. The overall profitability increase can be attributed to the profits derived from all the business segments of IOC Company, except for petrol, where they continued to sell the product on negative margins. Lanka IOC foresees shifting from conventional energy to unconventional energy sources for environmentally friendly auto fuels in the long term.

Three (3) companies are under the sustainable or safe zone in the commercial & professional services sector. They are Paragon Ceylon PLC, Lanka House Painters and Publishers PLC, and Gestetner of Ceylon PLC. Their average Z-scores are 13.06, 4.41 and 4.02, respectively. The market prices of Lanka House Printers and Publishers PLC were increased; however, there was a decrease in Gestetner of Ceylon PLC, and it fluctuated in Paragon Ceylon PLC. These companies are investing their money in diversification. They are setting new industry standards and are driven to make a difference in their quest to create wealth for Sri Lanka.

The transportation sector has one (1) company under the sustainable or safe zone. It is Expolanka Holding PLC. An average Z-score is 4.41. This company's market price decreased from 2015 to 2019. Expolanka Holdings is committed to advancing along a sustainable path following the vision of becoming one of the leading sustainable organizations in the industry. Expolanka believe a conscious effort at sustainable living and sustainable business practices

are vital to enhance their business and protect all life on this planet. A concentrated effort led the growth during five years in expanding their trade lane performance, improving their product portfolio, and growing their core customer base in terms of increased performances from their existing customers and servicing new strategic accounts.

The household & personal products sector has one (1) company under the sustainable or safe zone. It is Swadeshi Industrial Works PLC. The average Z-score is 3.65. This company's market price fluctuated from 2015 to 2019. Swadeshi Industrial Works PLC is the most sought-after Sri Lankan company providing a preferred solution for customers' care and cleaning needs in local and selected international markets.

The utility sector has one (1) company under the sustainable or safe zone. It is Vallibel Power Erathna PLC. The average Z-score is 23.53. This company's market price fluctuated from 2015 to 2019. According to the information published in the annual reports, this company's success began with a quest to deliver sustainable energy to power the nation. Sustainability profitability for their business means they provide a product that is both profitable and environmentally friendly. They have adapted their business model to take advantage of sustainability opportunities. Vallibel Company has much strength. The projects' prime geographical locations, good financial, people, and manufactured capital strength and good governance, risk management, quality management, and CSR practices.

The retailing sector has four (4) companies under the sustainable or safe zone. They are the Autodrome PLC, C.W. Mackie PLC, United Motors Lanka PLC, and Eastern Merchants PLC. The average Z-scores are 3.22, 3.58, 3.05 and 5.57, respectively. The market prices of United Motors Lanka PLC and Eastern Merchants PLC were decreased, and others have fluctuated market prices from 2015 to 2019. The annual reports revealed that these companies produce quality tyres, paints, wires, vehicles etc. All companies' sustainability efforts are under their economic, environmental and social pillars and their every target is set with a clear roadmap as to how it is to be achieved and is ultimately designed to improve their environmental and social performance.

The materials sector has eight (8) companies under the sustainable or safe zone. Chemanex PLC, Union Chemicals Lanka PLC, Bogala Graphite Lanka PLC, ACL Plastics PLC, Industrial Asphalts (Ceylon) PLC, Richard Pieris Exports PLC, Chevron Lubricants Lanka PLC, and Alumex PLC. The average Z-scores are 5.42, 6.29, 6.66, 5.31, 3.27, 4.19, 10.56, and 5.71 respectively. The market prices in three (3) companies decreased, increased in one (1) company and fluctuated in four (4) companies from 2015 to 2019. These companies produce rubber/polymer-related products. Consequently, these companies expand production

capacity, enhance product portfolios, extend distribution networks and infrastructure, have strategic partnerships, international quality standards, and grow their global market presence. Simultaneously, ensure compliance with regulatory requirements and provide clear direction on the decision-making process, promoting a culture of openness, productive dialogue, constructive dissent, employee empowerment, and engagement, thereby creating value for all stakeholders.

This sector has eight (8) companies under the sustainable or safe zone. Serandib Land PLC, Lee Hedges PLC, Equity Two PLC, Property Development PLC, Cargo Boat Development Company PLC, Colombo City Holdings PLC, C T Land Development PLC, and Overseas Realty (Ceylon) PLC. The average Z-scores are 12.4, 4.37, 6.40, 4.81, 16.50, 10.28, 3.33 and 3.71 respectively. The market prices fluctuated in seven (7) companies and decreased in one (1) company from 2015 to 2019. These companies develop housing, land, buildings, properties etc. The real estate industry is highly developing. Sri Lanka is moving in the right direction with the emphasis on infrastructure developments. It will play a significant role in improving the mobility of goods, cost efficiency, and daily commuting capability, thus increasing its intrinsic value to the business community. However, many other areas of the country, such as proper and consistent application of policies, political stability, ease of doing business and investment, and maintaining law and order, still require attention to attract global and local investment communities.

The capital goods sector has six (6) companies under the sustainable or safe zone. Kelani Cables PLC, Lanka Tiles PLC, Office Equipment PLC, Lanka Ashok Layland PLC, Hemas Holdings PLC and Central Industries PLC are among the six companies. The average Z-scores are 3.33, 3.70, 3.40, 3.85, 3.41, and 4.10, respectively. The market prices fluctuated in three (3) companies and decreased in three (3) companies from 2015 to 2019. These companies produce electrical solutions, vehicles, spare parts, and consumer and healthcare solutions. Apparently, they mainly focused on campaigns targeting professionals, influencers and decision-makers. Similarly, these companies are managing working capital, technology capacity expansion, sustainable sourcing, and concentrating on the design and quality of products.

The consumer services sector has fourteen (14) companies under the sustainable or safe zone. They are Tangerine Beach Hotels PLC, Ramboda Falls PLC, Hotel Sigiriya PLC, Pegasus Hotels of Ceylon PLC, Renuka City Hotel PLC, Royal Palms Beach Hotels PLC, The Fortress Resorts PLC, The Nuwara Eliya Hotels Company PLC, Asian Hotels & Properties PLC, Bansei Royal Resorts Hikkaduwa PLC, Hunas Falls Hotels PLC, The Kandy Hotels Company (1938) PLC, The Lighthouse Hotel PLC, and Trans Asia Hotels PLC. The average

Z-scores are 3.18, 4.35, 4.18, 3.53, 14.00, 3.83, 6.32, 7.02, 5.31, 17.52, 4.89, 4.20, 4.15, and 9.11 respectively. The market prices fluctuated in seven (7) companies and decreased in seven (7) companies from 2015 to 2019. They have a clear strategy to drive growth and create long-term value through their property and hospitality operations. They take a disciplined, yield-focused approach to capital deployment on their property. They look to optimize the value of their property and, where appropriate, extract value to fund longer-term sustainable growth. Further, their hospitality operations, consistently deliver a refreshed guest experience across their property and leverage their scale. It will drive growth and maintain high-operating margins.

The food, beverage and tobacco sector has fifteen (15) companies under the sustainable or safe zone. They are Harishchandra Mills PLC, Keells Food Products PLC, Nestle Lanka PLC, Raigam Wayamba Salterns PLC, Bairaha Farms PLC, Three Acre Farms PLC, Renuka Agri Foods PLC, Ceylon Tobacco Company PLC, Distilleries Company of Sri Lanka PLC, Ceylon Grain Elevators PLC, Ceylon Cold Stores PLC, Watawala Plantations PLC, Dilmah Ceylon Tea Company PLC, Convenience Foods (Lanka) PLC and Tea Smallholder Factories PLC. The average Z-scores are 7.77, 5.24, 10.12, 5.15, 3.81, 5.38, 3.04, 14.97, 4.66, 4.09, 6.06, 3.07, 10.27, 5.42, and 3.29 respectively. The market prices fluctuated in thirteen (13) companies and decreased in two (2) companies from 2015 to 2019. They provide excellent quality foods, soups, nutrition, taste and health need to the nation. The companies are providing quality, strong brands, innovation, availability, and convenience continues to be their operational process which propels their efforts to continuously deliver value to their customer. Sector-wise, a high percentage of financially sustainable companies are included Commercial and Professional Services, Household and Personal Products, Materials and Real Estate sectors.

The researcher identified that the present research Z-score classifies 35% of financially sustainable companies, 35% of distressed companies, and 30% of grey companies out of 191 companies. Accordingly, Al-Manaseer & Al-Oshaibat, (2018) concluded that 57.31% of safe companies and 38.09% of grey and distressed companies. It indicated the safety and failure of the financial position of these companies since they develop their activities and make good use of company funds, raising total assets notes, decreased total liabilities, and working capital may be due to lack of experience. The reasons were the same for this study. Further, Mohammed (2017) concluded that the Raysut Cement Company, which showed a poor financial performance in the first three years and another two years, showed a good performance. Therefore, it can be quoted as an investor-friendly company. Samarakoon & Hasan (2003), investigate predicting corporate distress in the Sri Lankan stock market. It

stated that the Z-score classifies 90% of the distressed firms and 60% of the non-distressed firms accurately. The overall success rate of 91% is observed using the Z-score. The out-of-sample evidence provided in this paper means that the Z-score model seems to have excellent potential in evaluating the risk of corporate distress and sustainability in smaller emerging markets. Empirical studies prove high accuracy and suitability for identifying sustainable financial companies through the Altman Z-score model (AlAli, 2018; and Lohana, 2014).

Gambler's Ruin Theory makes predictions concerning the growth and survival of the business; however, this study identifies financial sustainability in the companies through concerning many data (Liquidity, Profitability, etc.). It is affected by the company's growth and failure. This theory is used for predicting financial sustainability and bankruptcy in companies (Coad et al., 2013). Similarly, Life Cycle Theory is applied in business to explain the birth, growth, maturation, and death process of firms. At each stage, they share financial situations. When financial performance is high, the company's life cycle is high growth and survives in maturation. Financial sustainability is an effect on all stages of the life cycle and it helps many stakeholders to make the right decisions in the face of financial situations (Bayai & Ikhide, 2016). These theories are linked to financial sustainability and distress.

The percentage of companies with Z-scores (Sustainable/Safe zone) reached 35%. It indicated the safety of the financial position of these companies because they develop their activities and make good use of company funds. While companies with a low Z-score (Gray and Distress zones) reached 65%, companies are exposed to the risk of financial failure. As a result of a lack of experience in managing the fund, they did not develop their activities and misused company funds and economic and political issues arose. So, it indicates indicators the companies will expose to financial sustainability if they use the same financial or other policies they currently use. These financially sustainable companies are essential to investors, creditors, managers, regulatory bodies, employers, customers, government and society. The listed companies affirmed information for stakeholders through annual reports. They reported about product quality, job security, incentives and rewards, share price and liquidity, compliance with regulations, employment opportunities and support for community needs etc.

5. Conclusion

The study mainly sets out to identify the financially sustainable listed companies in Sri Lanka. The data for the study were obtained from annual reports for the period of 2015-2019. The study analyzes sustainable/safe zone, grey zone and distress zone under the research. The researcher used 191 companies out of the 289 companies and utilized sixteen (16) sectors out of twenty-one (21) sectors. Finally, this study identifies sixty-seven (67) companies as

financially sustainable, fifty-seven (57) companies as grey and sixty-seven (67) companies as distressed out of the 191 listed companies. Subsequently, the following study results investigated the identifying financial sustainable companies. Financial sustainability is understood as public administrations' ability to continue now and in current policies without causing the debt to rise continuously. Therefore, stakeholders need to pay great attention when making decisions. Moreover, Sri Lanka is a developing country because a small number of companies are sustainable. Thus, grey and distressed companies should try to change their strategies in companies to become financially sustainable. All companies overall faced some micro and macro-economic challenges from 2015-2019. The main thing is the Easter attacks and their repercussions affecting the economy in 2019. After these challenges, many companies' Z-scores have been decreased. Accordingly, contributions of the government, policymakers, managers in companies and stakeholders are required and a proper mechanism should be implemented to motivate all listed companies towards sustainability by providing all forms of assistance.

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CHAPTER THREE

Dynamics of Volatility Spillover between Stock Market and Exchange Rate among Developed Countries during the COVID-19 Pandemic

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Abstract

This study explored volatility spillover between the exchange rate market and the stock market of developed countries, namely Australia, Japan, Germany, Russia, and the United Kingdom for during the COVID-19 pandemic. The study uses daily stock return data and exchange rate changes from 01/11/2019 to 31/10/2021, and the EGARCH model was employed to measure the volatility. By employing EGARCH, the study captured the asymmetric shock in the data series. The Granger Causality test provides the results for the volatility spillover. According to the findings, Australia, Russia, and the UK have significant bidirectional volatility spillover between stock and exchange rate markets. Only Japan is significant for unidirectional volatility spillover in inter volatility spillover effect. This study also analyzes the intra-volatility effect between other countries. The results prove that only the Austrian stock market and exchange rate market are significant for the bidirectional volatility spillover with other countries' stock markets and exchange rate markets. Japan and German have significant unidirectional volatility spillover with the other two markets besides Australia. Russia does not have a significant intra-volatility spillover effect. Therefore, this study gives evidence of volatility spillover during the COVID-19 pandemic. The findings will provide valuable information for fund managers, policymakers, investors, and future researchers. Especially investors who invest in diversified stock markets can get an idea about the stock market volatility and its spillover effect to make the most rational decision regarding the portfolio investment.

Keywords: *COVID-19, EGARCH Model, Exchange Rate, Granger Causality Test, Volatility Spillover.*

1. Introduction

With globalization and financial liberalization, interdependency between nations and the stock markets has increased over the past years. Mukherjee & Mishra (2010) states that the most focused factor is regional economic integration; the lower geographical distance, similar economic patterns, and similar cultural aspects increase the interdependency between countries. Along with removing restrictions in the stock market, foreign investment has become more popular among investors. The increase in foreign investment triggers the usage of foreign currency too. So the demand for the currencies and equity flow create a link between the exchange rate and the stock return. Through that linkage, these two become interdependent and develop a relationship between two financial markets.

It is evidenced that along with the increasing interdependency of the two markets (Stock and currency market), volatility transmission has also increased between the stock market and the foreign currency market. Therefore, it is vital for rational investors to be in touch with the two-market behavior because the volatility transmission can create an international portfolio risk. It will not be rational if investors go for investing in the global market without considering foreign currency market information.

Information plays a significant role in volatility co-movement and volatility spillover. When new information arrives in the stock market, volatility changes (Ross, 1989). Similar to Markowitz's theory, fundamental financial theories explain that investors should diversify their investments and portfolio to reduce risk. Investors have many opportunities to make foreign investments and profit in highly developed markets. With that perception, many researchers are curious about the relationship between these two markets, and much literature explain that there is a relationship between the two markets (stock and currency).

Generally, countries' foreign currency market environment is very dynamic as much as the stock market. These two markets are highly susceptible to economic environment (like both macro and microeconomic environments). Given the importance, many articles analyze the exchange rate volatility and the stock market relationship in academic history. Specially, these two markets are susceptible to trends like disasters, crises, political uncertainty, environmental events, and economic shock (Hillier & Loncan, 2019) as well as macroeconomic factors like economic growth, recessions, inflation, and interest rate. Hence, that is why, with new information; two markets show the volatility than usual.

Several literature revealed the impact of unexpected events like shutdowns, terrorism, and crisis government decisions. That event contains information that can improve the variability of specific markets (Narayan, 2018). Based on that point, this report hypothesizes that the

COVID-19 situation improves the dynamic relationship between the stock market and the foreign currency market.

As an unanticipated disease, the COVID-19 outbreak and its quick spread throughout the world had led the countries into a severe crisis creating economic and financial uncertainties due to great lockdowns and loss of human capital. The COVID-19 outbreak has spread to several sectors, triggering heavy losses, especially in banks and finance, energy and gas, industrials, airlines, and travel, showing the adverse impact on equity indices. Considering the statistics provided by the World Health Organization (WHO), many developed countries have suffered more compared to some other countries. On the other hand, countries like the UK. Japan, Germany, Australia, and Russia contribute to the world trading process. Many countries of the world satisfy their importing needs from these countries and the five countries listed in the top 20 countries having the most extensive stock market capitalization globally.

Moreover, this pandemic has caused substantial investment losses in the world market (Zhang, 2020). During a crisis, stock market volatility generally rises sharply, resulting in spillovers identified across markets. Hence, it is confirmed the European stock market interdependence during COVID-19. Likewise, Hung (2020) investigates the pre and during COVID-19 spillovers between crude oil prices and five developed stock markets in Europe; the study states more spillover effects between crude oil prices and the stock market. Many finance researchers are interested in volatility spillover, and international transmissions have existed between countries recently (Garg, 2021).

The COVID-19 pandemic is the most significant pandemic that was experienced in recent history, showing an overwhelming effect on economies more than the other health crises in the past. With such heightened economic and financial risk and uncertainty during this severe, terrible COVID-19 pandemic, great lockdowns, and other travel restrictions, investors and portfolio managers are keen to understand the transmission of shocks across equity markets and diversification of portfolios at a minimum risk. Thus, it is crucial to investigate the volatility spillovers during COVID-19 for early alarm and to track the degree of the current crisis. Hence, the objective of this study is to examine the developed countries' interactions and volatility spillover between the stock market and foreign exchange market during the COVID-19 outbreak and before the outbreak. The UK, Japan, Russia, Germany, and Australia represent the developed countries.

This paper employed the EGARCH model and used the daily data of six countries' stock market indices and the foreign currencies rate, from 1st January 2011 to 30th September 2021, to address the arguments. The findings will help investors and portfolio managers manage

risk, determine decisions in the allocation of assets, and diversify their portfolios to achieve maximum benefit. The governments can maintain economic and financial stability by designing effective policies by uncovering the spillover effects among these stock markets.

2. Previous Literature

In recent years, globalization and technological growth have interconnected all the aspects of the world such as finance, economy, education, health, politics, etc. Hence, countries influence each other with different proportions. This is also exemplified by the financial market. Financial and trade linkages will provide a foundation for market integration and volatility spillover. Most countries relaxed the restrictions of capital markets, and exchange through the market became accessible to transactions. Those things make space for new information in the capital markets, leading to increased market behaviors on prices and return. Interrelationships of the equity market worldwide have increased, and many studies have focused on stock market integrations and the volatility spillover.

The exchange rate gives the international price for the domestic currency, and it reflects the purchasing power of the countries in the international market. Studying the exchange rate can interpret a lot of information about the fundamental economy of countries. Stock price indices are very sensitive and open to the real economy of the countries and show changes along with the sudden changes in the country's economy. So exchange rate and the stock market indices are essential parts of the country's economy and should give more attention to controlling the economic fluctuation in the countries.

With close economic indicators and integrations, financial market indicators show more intimate relationships. With that relationship, exchange rate fluctuation (volatility) and stock market fluctuation (volatility) show integration. All the levels are interlinked, and any changes in any level will cause fluctuation in other levels. If there are no external shocks, most levels are generally hard to see considerable fluctuation (Jiahong, 2020).

Importantly two theoretical perspectives describe the relationship between the exchange rate and the stock market price indices. "Flow oriented" model (Fischer, 1980) and the "Stock oriented" model (Frankel, 1983).

The flow-oriented model describes that exchange rate fluctuations influence international trade as well as domestic trade, and in terms of that, final real output and stock price as well (Fang, 2002; Wongbangpo, 2002 and Phylaktis, 2005). When the domestic stock prices increase, foreign direct investors tend to demand domestic stock and increase the money

demand for the assets transactions (Frankel, 1983; Branson, 1985; Tai, 2007 and Koulakiotis, 2015).

By studying the stock-oriented and flow-oriented models, this study can get the fundamental theoretical background for identifying the relationship between two financial markets (exchange rate and stock market). In the two models, transmission mostly happens through the country's capital and current accounts. When the two orient models combine, we can get an idea about the relationship between the two markets. An uncontrolled stock market, and the exchange rate market significantly influence each other.

Besides, the open market concepts and globalization and countries' political and trade policies create a lot of linkages between countries. Linkage defines as the ability to buy and sell goods or securities in the common market by any country. So trade linkage is an association built by countries for the purpose of trading goods and services. Financial linkage is one of the country's stock markets that allow trading of foreign country stock in their market, and these exchanges create financial linkages between countries. Cote (1994) explains trade linkage based on how one nation's currency matches another nation's currency depreciation and how price volatility raises among trading countries and their market conditions. Forbes (2002) addresses how linkage transmits the crisis from one country to another and whether it is a determinant of the transmission of the financial crisis.

While the theoretical perspective shows both positive and negative relationships between the stock market and exchange rate, a considerable number of empirical works reference the volatility spillover between the two markets. Kanas (2015) references the volatility spillover of six countries; Japan, the United States, the United Kingdom, Germany, France, Canada stock market, and the exchange rate market. It states that there is significant influence from the stock market to the exchange rate market except for Germany. However, it also results in a weak influence from the exchange rate market to the stock market. In addition, Chang (2009) found significant volatility spillover from the stock market to the exchange rate market. Yet, it hardly discusses the spillover effect from the exchange rate market to the stock market. Chen (2004) also discusses the significant volatility spillover between the stock and exchange rate markets. Besides, Aloui (2007), Andreou et al. (2013), Chkili (2012), Choi (2010), Francis et al. (2006), Mishra (2007), Qayyum (2006), and Xiong (2015) conclude that there is bidirectional flow volatility between the stock market and the exchange rate market.

This study analyzes the volatility spillover between stock market indices and exchange rates during the COVID-19 pandemic in selected developed economies. Developed countries contribute much more to the world economy; with the unexpected shock created by COVID-

19 leading to stock price fluxions and exchange rate fluctuation (OECD, 2020). Many empirical studies are done during unforeseen events, like financial crises, government lockdowns, terrorism, and health issues, and prove that there are influences from those unexpected situations (Narayan, 2018). Accordingly, Baker et al. (2020) identified the impact of the current pandemic on stock market volatility and documented that the government's limitations on commercial activity and consumer restrictions are the primary reasons for increased volatility. The government's response to COVID-19 could maintain the international stock market volatility (Zaremba et al., 2020). It states that the countries that take server action to mitigate COVID-19 increase volatility. Onali (2020) concluded that in the USA, along with the increase of positive cases and death in COVID-19, stock market volatility also increased

3. Data and Methodology

This study used daily stock market return and exchange rate data from 01/11/2019 to 31/10/2021 to capture more detailed and informative information from the period of the COVID-19 pandemic. In addition, six stock market indices and daily foreign currency prices in the exchange market were used from each selected country (United Kingdom, Australia, Japan, Russia, and Germany) as secondary data.

The first step was to calculate the daily index returns using the closing stock price index of each stock market. Thus, returns were calculated by using the following function:

$$R_y = (I_t - I_{(t-1)}) / I_{(t-1)} \quad (1)$$

$$R_{er} = P_t - P_{(t-1)} \quad (2)$$

Equation (1): Measurement for the stock return

Equation (2): Measurement for the foreign currency change

Equation (1) denotes stock price returns, the index price of day t, and t-1 represents the index value of the day. Equation (2) represents the change in foreign currencies.

After calculating the return for each country, to commence the volatility modeling, the first step was to check whether the data set is stationary to prove that there is no time impact on mean and auto-covariance. The stationary was tested using the Unit root tests such as Augmented Dickey-Fuller (ADF) and Phillip and Perron (PP) criteria at a 95% confidence level. The following hypothesis was used for determining the stationary/ non-stationary pattern.

H_0 = Data series has a unit

H_1 = Data series does not have a unit root

After checking the stationary of the data series, for developing the mean equation modeling, and measuring volatility generally, the mean equations were developed as starting points, like the Auto-regressive model (AR), Moving Average model (MA), and ARMA models. Combining Auto-regressive and moving averages, form ARMA (p,q) equation; can be identified as mean models.

$$Y_t = \alpha+\alpha_1 Y_{(t-1)}+\alpha_2 Y_{(t-1)}+\cdots+\alpha_p Y_{(t-p)}-\theta_1 \varepsilon_{(t-1)}-\theta_2 \varepsilon_{(t-2)}-\ldots-\theta_q \varepsilon_{(t-q)} \quad (3)$$

So to identify the conditional mean in the data series, the model that is developed by using the ARMA approach should be used.

$$R_{(y/er)} = \alpha_0+\alpha_1 R_{(y/er-1)} \quad (4)$$

As a first approach to the main modeling, two market data analyses for mean modeling AR(1) model (equation 04). After fitting the mean model for each data, conditional mean equations (5) and (6) can be used.

$$R_y = \alpha_0+\alpha_1*R_{(y-1)}+\alpha_2*R_{(er-1)} +\varepsilon_t \quad (5)$$

$$R_{er} = \alpha_0+\alpha_1*R_{(er-1)}+\alpha_2*R_{(y-1)}+\varepsilon_t \quad (6)$$

Equations (5) and (6) represent the return of stock prices and changes in exchange rate prices. $\alpha_0$intercept, $\alpha_1$impact of the previous day's stock return, and $\alpha_2$impacts from the exchange rate to the stock market. After analyzing the conditional mean, it was essential to determine whether these data have the ARCH effect of further analysis of volatility spillover.

The Autoregressive Conditional Heteroscedasticity (ARCH) model analyzed the volatility after getting a significant mean model. Before that, it is essential to test whether the fitted mean equation has an ARCH effect or not; for that, the Lagrange Multiplier test (ARCH LM) is used.

H_0 = ARCH effects are not significant

H_1 = ARCH effects are significant

If the ARCH test; p-value is less than 0.05, ARCH effects are significant, and the heteroscedasticity effect is significant; that means the variance of residuals is not equal at the different lag levels. The central analytical part can be started with the confirmation of the ARCH effect.

EGARCH Model

This study's main objective is identifing volatility spillover between two financial markets (exchange rate and stock markets). This study employed the Exponential Generalized Autoregressive Conditional Heteroscedasticity (EGARCH) (Nelson, 1991). Unlike GARCH modeling, the EGARCH model can potentially capture both symmetric and asymmetric information. Here, symmetric shocks were also described as positive and asymmetric shocks; negative shocks. Most studies argue that negative shocks are most likely to make more volatile than positive shocks. Therefore, the EGARCH model was selected to capture symmetric and asymmetric volatility shocks between the stock and exchange rate markets as per the study's objectives. Many empirical studies have used the EGARCH model for analyzing volatility spillover (Kanas, 2000; Beer, 2011; Adjasi, 2008; Choi, 2010; Mishra, 2007; Morales, 2008; O'Donnell, 2009; Okpara, 2012; Qayyum, 2006 and Yang, 2004).

The following equation describes the EGARCH(1,1) model;

$$H_t = \beta_0+\beta_1 H_{(t-1)}+\beta_2 |(\varepsilon_{t-1})/\sqrt{(H_{(t-1)})}|+\vartheta (\varepsilon_{t-1})/\sqrt{(H_{(t-1)})} \quad (7)$$

In equation (7), H_t represents the log of conditional variance of markets (stock market /exchange rate market) β_0 is constant volatility and $\beta_1 H_{(t-1)}$ describes the function of volatility $\beta_2|(\varepsilon_{t-1})/\sqrt{(H_{(t-1)})}$ capture the reaction of volatility toward information and $\vartheta (\varepsilon_{t-1})/\sqrt{(H_{(t-1)})}$ measure the asymmetric volatility of effect.

This study analyzes the volatility spillover from the stock market to the exchange rate market and the exchange rate market to the stock market.

$$H_{(t(sm))} = \beta_0+\beta_1 H_{(t-1)}+\beta_2 |(\varepsilon_{t-1})/\sqrt{(H_{(t-1)})}|+\vartheta (\varepsilon_{t-1})/\sqrt{(H_{(t-1)})} \quad (8)$$

Equation (8) is the conditional variance for the volatility spillover from the foreign exchange rate to the stock market.

$$H_{(t(er))} = \beta_0+\beta_1 H_{(t-1)}+\beta_2 |(\varepsilon_{t-1})/\sqrt{(H_{(t-1)})}|+\vartheta (\varepsilon_{t-1})/\sqrt{(H_{(t-1)})} \quad (9)$$

Equation (9) is the conditional variance for the volatility spillover from the stock market to the foreign exchange rate.

Granger Causality Test.

Granger (1969) introduces the Granger Causality test for dependent variables' time series data characteristics in economics and econometrics. Using the Granger causality test, any researcher can identify if any information from past and current values contained by one variable represents the additional information of the future value of another variable. There is

a lot of empirical evidence for practical use; Chen (2004), Okunev (2000), Okunev JW (2000), Cees Diks (2006), Jian Ke (2010) and Umm E.Habiba (2020).

Accordingly, this study's main purpose is to prove the directional volatility spillover between the two financial markets (exchange rate and the stock exchange). However, to prove the direction (bidirectional or unidirectional) since the EGARCH model was not enough to identify the definite relation, this study used the Granger Causality test. Using the Granger Causality test results, this study interprets the direction of the volatility spillover. Volatility generated by EGARCH will be the variable for the Granger causality test.

H_0 = Variables does not granger cause

H_1 = Variables does granger cause

4. Results and Discussion

This study used data of two years since the first case record of the COVID-19 outbreak (11/01/2019 – 10/31/2021). The volatility model was used to analyze the secondary data collected using invwsting.com. The Exponential Generalized Autoregressive Conditional Heteroscedasticity (EGARCH) model was employed to identify the volatility spillover between the two financial markets.

Descriptive Statistics

The primary analysis that was employed to identify the behavior and patterns of the data. Descriptive statistics were helpful in observing the general characteristics of the data. The following tables summarize the statistical output of the two financial markets. Table 1 present the descriptive statistical summary of the foreign exchange rate market.

Table 1: Descriptive statistics summary

	Exchange rate					Stock market				
	AUD_USD	EUR_USD	GBP_USD	JPY_USD	RUB_USD	YAUR	YGMN	YJPN	YRUSS	YUK
Mean	0.0001	5.51	9.00	8.11	0.0001	0.0002	0.0004	0.0003	0.0009	0.0001
Median	0	0	0	0	0	0	0	0	0	0
Std. Dev.	0.0055	0.0034	0.0048	0.0039	0.0072	0.0118	0.0132	0.0098	0.0136	0.0115
Skewness	-0.7823	-0.2607	-0.5766	1.1275	1.8861	-1.2778	-0.7883	0.1782	0.3429	-1.1018
Kurtosis	10.7297	6.8474	10.8659	22.2488	19.901	18.8566	23.748	10.6903	9.4471	21.7942
Jarque-Bera	1894	459	1925	11440	9133	7857	13187	1805	1280	10906
Prob.	0	0	0	0	0	0	0	0	0	0

Most countries skewed negatively, indicating that data sets were asymmetrical and not distributed normally according to the kurtosis value of all countries in both markets. Further, both markets reject the assumption of normality because the Jarque-Bera test was significant (p-value <0.05) by rejecting the null hypothesis. Thus, the data sample was not normally distributed. Dayaratne (2010), Garg (2021) and Iqbal (2016) also provided the same findings in their studies.

Unit root test

Unit root test aimed to identify whether the data is stationary or not. In time series analysis, measuring data stationarity was a prevalent assumption. Stationary data means that the data series did not have any trend or intercept, and the mean and standard deviation were the same at any point of the data series.

Table 2: Unit root test summary

	Exchange rate market		Stock market	
	PP	ADF	PP	ADF
Australia	-23.4799*	-23.3507*	-32.0737*	-32.3388*
Japan	-29.2276*	-29.2276*	-25.8369*	-16.4245*
Germany	-25.0397*	-16.1112*	-27.6062*	-27.519*
Russia	-27.0696*	-16.5302*	-25.7418*	-25.7418*
UK	-23.2592*	-23.2592*	-26.936*	-26.9171*

*-5% significant level.

There are no special models or criteria to prove the stationary of data series in econometrics. Most empirical studies have used the unit root test to check the stationary. Consequently, this study employed the unit root test for all the research variables. The summary of the output of the unit root test is described in table 2. The provided output exchange rate change and the stock return index were stationary at the levels. Simultaneously, it proved that the data series has stationary data by rejecting the null hypothesis under Augmented Dickey-Fuller (ADF) test and Phillips – Perron (PP) test at 5% significant level. This proved that there were no biased data and this data series's output.

Model Fitting

Volatility models are mostly generated using the ARMA model, as explained in section 03 the first step to analyzing the data series for ARMA modeling (mean model). After fitting a model for ARMA most important analysis is the ARCH LM test. Performing the ARCH LM test helps to identify whether there is a heteroscedasticity effect.

Table 3: Mean model and ARCH effect of two markets

	AR(1)	AR(2)	AR(8)	ARCH effect	AR(1)	AR(2)	AR(8)	ARCH effect
Australia	0.1429*			4.3420*	-0.1790*			28.9615*
Japan	-0.07901*			48.2870*	0.0462*			38.9893*
Germany	0.0747*			22.8475*			-0.1493*	0.2707
Russia		0.0799*		11.8923*	0.0487*			22.2490*
UK	0.1465*			42.0101*			-0.1794*	8.8302*

Australia, Japan, Germany, and the UK were significant for AR(1) mean model and only Russia was significant for AR(2) model for the exchange rate. Besides, Australia, Japan, and Russia were significant for AR(1) model, while Germany and the UK were significant for the AR(8) model for stock markets.

EGARCH Modeling

Table 4: EGARCH results from one country's exchange rate market to another country's stock market

	Australia	Japan	German	Russia	UK	ARCH	leverage	GARCH
Australia	0.1776*	0.3153*	-0.1749	-0.0396	0.0843	0.0850*	-0.1279*	0.9856*
Japan	0.4011*	0.6454*	-0.0232	-0.0341	0.0790	0.0551*	-0.1137*	0.9818*
Russia	0.2020	-0.0014	0.0226	0.0827	-0.3077*	0.5635*	-0.1148*	0.0615
UK	0.1693*	0.1245	0.1143	-0.0979	-0.2554*	0.0757*	-0.1218*	0.9887*

* 5% significant level.

Table 5: EGARCH results from one country's stock market to another country's exchange rate market

	Australia	Japan	Russia	UK	ARCH	leverage	GARCH
Australia	-0.0098	0.0914*	0.0161	-0.0496*	0.4215*	-0.0597	0.0948
Japan	-0.0008	-0.0299*	0.0093	-0.0152	0.1524*	-0.0803*	0.9592*
German	0.0247*	0.0434*	-0.0075	0.0014	0.3719*	0.0080	-0.0962
Russia	0.0223	-0.0401	-0.0119	0.0028	0.1032*	0.0766*	0.9797*
UK	0.0153	0.0711*	0.0076	-0.0309*	0.5004*	-0.0863*	-0.2934*

* 5% significant level.

Table 4 summarizes the EGARCH calculations for volatility from the foreign exchange rate market to the stock market. The ARCH parameter was significant in Russia, Australia, Japan, and the UK and gave positive volatility from the exchange rate market to the stock market. In addition, the five exchange rate market provides asymmetric shock for the four stock markets. This is because four leverage parameters give negative results for all the stock markets. The GARCH parameter believed that the Russian stock market is insignificant. It states that other countries' past volatility of the exchange rate market does not help to forecast the Russian stock market's present volatility.

Table 5 summarizes the cross-volatility analysis results from the stock market to the exchange rate market. In this volatility combination, the Australian and Russian exchange rate were not significant for the volatility forecasting from the past data of the stock market past information. These two countries also did not show significant leverage. However, the other three countries: Japan, Germany, and the UK were significant for the GARCH and leverage parameters; for the leverage, all three countries showed negative shock for the volatility during COVID-19. Besides, all five exchange rate markets showed positive volatility with other countries' stock markets.

ARCH LM test was run for all EGARCH models to confirm any heteroscedasticity effect in the data series. However, the data did not become significant for the heteroscedasticity effect. It proves that there is no more heteroscedasticity effect to check.

Granger Causality Test

According to the results, the United Kingdom's two financial markets have bidirectional volatility spillover. Japan's exchange rate market and stock market were not significant for the bidirectional volatility spillover during the COVID-19 pandemic. Results state that stock-oriented model did not become significant while the flow-oriented model was significant for the volatility spillover. Volatility spillover showed bidirectional spillover between two financial markets in Russia and Australia.

Table 6: Granger causality test for each country

Null Hypothesis:	Obs	F-Statistic	Prob.
YUKS does not Granger Cause POUND	728	42.8677	0.0000*
POUND does not Granger Cause YUKS		9.63223	0.0000*
YJPNS does not Granger Cause JPYS	728	0.17291	0.8412
JPYS does not Granger Cause YJPNS		82.2671	0.0000*
RUB does not Granger Cause YRUSS	727	10.8802	0.0000*
YRUSS does not Granger Cause RUB		10.8727	0.0000*
YAUS does not Granger Cause AUD	637	19.8044	0.0000*
AUD does not Granger Cause YAUS		18.4389	0.0000*

Table 7: Intra volatility spillover

Null Hypothesis:	Obs	F-Statistic	Prob.
YAUS does not Granger Cause AUD	637	19.8044	0.0000*
AUD does not Granger Cause YAUS		18.4389	0.0000*
YJPAN does not Granger Cause AUD	728	34.1711	0.0000*
AUD does not Granger Cause YJPAN		22.0313	0.0000*
YRUS does not Granger Cause AUD	727	0.39404	0.6745
AUD does not Granger Cause YRUS		2.13916	0.1185
YUKC does not Granger Cause AUD	728	26.9844	0.0000*
AUD does not Granger Cause YUKC		17.9028	0.0000*
YAUS does not Granger Cause EURO	637	23.3702	0.0000*
EURO does not Granger Cause YAUS		0.22994	0.7946
YJPAN does not Granger Cause EURO	728	25.2138	0.0000*
EURO does not Granger Cause YJPAN		2.05449	0.1289
YRUS does not Granger Cause EURO	727	0.14402	0.8659
EURO does not Granger Cause YRUS		0.70754	0.4932
YUKC does not Granger Cause EURO	728	26.6784	0.0000*
EURO does not Granger Cause YUKC		0.59129	0.5539
YAUS does not Granger Cause YEN	637	3.85655	0.0216*
YEN does not Granger Cause YAUS		64.8598	0.0000*
YJPAN does not Granger Cause YEN	728	0.16512	0.8478
YEN does not Granger Cause YJPAN		82.8624	0.0000*
YRUS does not Granger Cause YEN	727	0.93989	0.3911
YEN does not Granger Cause YRUS		2.20829	0.1106
YUKC does not Granger Cause YEN	728	2.01439	0.1341
YEN does not Granger Cause YUKC		87.2478	0.0000*
YAUS does not Granger Cause RUB	636	14.2741	0.0000*
RUB does not Granger Cause YAUS		31.6258	0.0000*
YJPAN does not Granger Cause RUB	727	27.8021	0.0000*
RUB does not Granger Cause YJPAN		5.83129	0.0031*

YRUS does not Granger Cause RUB	727	0.56043	0.5712
RUB does not Granger Cause YRUS		2.72196	0.0664
YUKC does not Granger Cause RUB	727	28.3135	0.0000*
RUB does not Granger Cause YUKC		4.37913	0.0129*
YAUS does not Granger Cause POUND	637	65.7909	0.0000*
POUND does not Granger Cause YAUS		28.7634	0.0000*
YJPAN does not Granger Cause POUND	728	25.1434	0.0000*
POUND does not Granger Cause YJPAN		0.48486	0.616
YRUS does not Granger Cause POUND	727	0.69437	0.4997
POUND does not Granger Cause YRUS		0.61731	0.5397
YUKC does not Granger Cause POUND	728	37.5134	0.0000*
POUND does not Granger Cause YUKC		10.7157	0.0000*

Source: Output of analysis

Australian two financial markets show bidirectional volatility spillover with every country's two financial markets. Japan's exchange rate market showed a bidirectional spillover with the Australian stock market and a unidirectional volatility spillover with the UK stock market. Moreover, the Japanese stock market showed a clear bidirectional volatility spillover between the exchange rate market and Australia, Germany, and Russia. Besides, the exchange rate market of the UK shows unidirectional volatility spillover. Russian stock market did not relate to other countries' exchange rate markets. However, the exchange rate market of Russia showed bidirectional spillover with all other countries stock markets. The German exchange rate market only showed the unidirectional volatility spillover from the other countries stock markets. Accordingly, only the Australian and Japanese stock markets showed a relation with the exchange rate market of the UK. Moreover, Australia has a unidirectional, and Japan has a bidirectional spillover with the exchange rate market of the UK. Lastly, the UK stock market has a bidirectional volatility spillover with Russia and a unidirectional volatility spillover from the Japanese exchange rate market, and Australia and Germany have a unidirectional spillover from the UK exchange rate market.

5. Conclusion

This study aims to find the volatility spillover effect between two financial markets. After developing the ten hypotheses under the two main objectives, this study presents the following findings.

Results of the volatility analysis from the EGARCH model state that there is significant positive volatility between the exchange rate market and the stock market during the pandemic period besides the German stock market. On the other hand, there is a negative shock in the volatility during the COVID-19 pandemic. Further, two financial markets show asymmetric shocks in all five countries.

First objective states that there is bidirectional volatility spillover between foreign exchange and stock markets in each country separately. As for this objective, this study ran an econometric model and stated the finding as three countries besides Japan and Germany, showing the significant bidirectional volatility spillover between the two financial countries. But unexpectedly, Japan showed unidirectional spillover, while German Stock returns do not significantly affect the ARCH effect.

Second objective stated that there was a bidirectional cross-volatility spillover between one country's stock market and other countries' exchange markets. Australian two financial markets showed bidirectional volatility spillover with every country's two financial markets. Japan's exchange rate market showed a bidirectional spillover with the Australian stock market and a unidirectional volatility spillover with the UK stock market. On the other hand, the Japanese stock market showed a clear bidirectional volatility spillover between the exchange rate market and Australia, Germany, and Russia. Besides the exchange rate market of the UK, it showed unidirectional volatility spillover. Although the Russian stock market did not relate to other countries' exchange rate markets Russia showed bidirectional spillover with all other countries' stock markets. The German exchange rate market only showed the unidirectional volatility spillover from the other countries stock markets. Apparently, only the Australian and Japanese stock markets showed a relation with the exchange rate market of the UK. Further, Australia has a unidirectional, and Japan has a bidirectional spillover with the exchange rate market of the UK. Lastly, the UK stock market has a bidirectional volatility spillover with Russia and a unidirectional volatility spillover from the Japanese exchange rate market, and Australia and Germany have a unidirectional spillover from the UK exchange rate market.

Most countries showed significant bidirectional volatility spillover with every two financial markets separately and other countries during the COVID-19 period.

The findings provide investors and fund managers with valuable information on portfolio diversification. They can take advantage of international investments because of the diversification of the market. To benefit from diversification, one should better know other stock markets, exchange rate market behaviors, and volatility transmissions as it can help maximize profit while minimizing risk. The policymakers can develop the most suitable strategies/policies to protect the two financial markets and economies in a critical situation like the COVID-19 health pandemic. Moreover, businesses interested in leading their business can make rational decisions for their companies.

Consequently, this study focused only on the period of the COVID-19 pandemic. As per the future directions, future research can be focused on comparing the results during and after the pandemic. Further, different countries' samples can be applied besides using this study's sample if there is an additional variable for analysis. In addition, since this study used the EGARCH model and Granger causality test to identify the volatility and the volatility spillover, future research can use different statistics and methodologies.

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CHAPTER FOUR

Impact of Foreign Direct Investment Inflows on Domestic Firm Productivity with Special Reference to Sri Lankan Manufacturing Sector

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Abstract

The role of Foreign Direct Investment (FDI) inflows in a developing country, can be recognized as a major influence on the economy or the productivity of the host country. A country must have the ability to create numerous ways and means to attract FDI inflows to the country, since it is acting as a major channel for the development of the host country by creating a great platform for higher productivity of the host country's economy. Domestic firms can learn and uplift their competitiveness with the help of FDI which is carried out by multinational enterprises. This research will be an attempt to examine whether the FDI inflows impact the productivity of domestic firms in the Sri Lankan manufacturing sector. Further, it explored the long-run relationship between FDI inflows and the productivity of domestic firms in Sri Lankan manufacturing industries. Data were collected from 2010 to 2019 and they were analyzed using a panel data regression model to achieve the major objective of the study. A fixed effect model was selected as the fitted model for the study and it revealed a significant positive impact of FDI on the output. A panel cointegration model is used to explore the long-run relationship and it is evidenced that there is no long-run relationship among variables.

Keywords: *Cointegration, Foreign Direct Investment, Firm Productivity.*

1. Introduction

Foreign Direct Investment (FDI) can be identified as an investment that is made by a firm or individual in one country into business interests located in another country. Generally, FDI happens when an investor establishes foreign business operations or acquires foreign business assets in a foreign company. In other words, FDI refers to a long-term investment by an investor in an enterprise in another economy, resulting in lasting interest with significant influence over the overseas enterprise. Typically, FDI occurs through mergers and

acquisitions of the setting up of business operations by the investor in the foreign economy. Moreover, FDI is measured by the sum of three components known as equity capital, retained earnings and net inter-company loans.

Besides, there are more benefits that are arisen from FDI for both the host economy and the investor. Economic stimulation, development of human capital, job creation, knowledge transfers, and technological transfers are some of the benefits for the host economy while market diversification, tax incentives, lower labour cost, preferential tariffs and subsidies are some of the benefits for the investor. For investors, undertaking FDI will help to build distribution networks and gain access to new technologies or natural resources. Furthermore, it is depicted that there are different types of FDI namely horizontal FDI, vertical FDI, conglomerate FDI and platform FDI. Horizontal FDI takes place when a company invests in another company in a different country where both companies produce similar products. This can be recognized as the most common type of FDI. Vertical FDI happens when an investment is made within a typical supply chain in a company. In this scenario it is not an essential fact for companies to be in the same industry. On the other hand, conglomerate FDI occurs when investments are made in two entirely different companies of completely different industries. If a business expands into a foreign country and the products manufactured are exported to a third country, it is explained as a platform FDI (Broking, 2021).

Assuredly, a developing country like Sri Lanka can reap benefits from FDI inflows in a significant manner. Basically, FDI can boost economic growth by creating job opportunities. It will accelerate productivity and make the economy more competitive. Then, FDI can drive technology exchange and innovations which will pave the way to be replicated by domestic firms and enhance productivity. Similarly, FDI can strengthen the revenue of the government by elevating tax revenues (Nenova, 2018).

From time immemorial, Sri Lanka is a country that is rich in natural resources. Even the geographical position where Sri Lanka is located in the Indian Ocean, paves the way to attract multiple foreign businesses, since Sri Lanka is considered to add immense strategic value to the international maritime trade sector by being located in the center of the Indian Ocean. Not only natural resources, but also Sri Lanka is capable enough to maintain a high level of education with an adult literacy rate of over 90% throughout these years (Macrotrends.net, 2021). This indicates that Sri Lanka has highly trainable workers. Align with that, Sri Lankan workers can reap the utmost benefit which is arisen from FDI inflows.

Generally, it is believed that joint ventures can derive more benefits for domestic firms than wholly owned subsidiaries. Joint ventures play a vital role as a more efficient mechanism for

the transfer and learning of novel technology and novel knowledge that are embedded in organizations. Basically, joint ventures facilitate both local and foreign partners to exploit each other's strengths. Here, they work together and local knowledge will be contributed by local partners while advanced knowledge-based assets will be provided by foreign partners. Consequently, this close interaction between local partners and foreign partners will lead to mutual learning between foreign and domestic firms by transferring knowledge-based assets from multinational enterprises (Konara and Wei, 2016).

Predominantly, the role of FDI inflows in a developing country, can be recognized as a major influence on the economy or the productivity of the host country. Therefore, being a host country, Sri Lanka must have the ability to create numerous ways and means to attract FDI inflows to the country since it is acting as a major channel for the development of the host country by making a great platform for higher productivity of the host country's economy. Accordingly, domestic firms can learn and uplift their competitiveness with the help of FDI which is carried out by multinational enterprises. Though there are various ways for FDI inflows to the country, it is an essential thing to get considered whether those arrived FDI is absorbed properly. As long as, they are not absorbed properly or they waste in vain, definitely the host country would collapse in achieving their pre-determined goals and objectives which have been designed to make fruitful with the aid of FDI inflows. Therefore, this research will be an attempt to examine whether the FDI inflows matter the productivity of domestic firms in the Sri Lankan manufacturing sector. At the same time, this research will make an effort to observe the long-run and short-run effects of FDI on the productivity of domestic firms in the Sri Lankan manufacturing sector.

When it comes to the Sri Lankan context, there are only a handful of research which have conducted in the area of FDI. Most of them are about determinants of FDI. If the country is attracting FDI inflows, it is necessary to scrutinize whether the host country exploits the benefit at the utmost level in a proper way. Simultaneously, the host country must be strategic enough to attract more FDI inflows to the country and uplift their economy by increasing productivity.

As a developing country, Sri Lanka must pay much attention to the area of FDI inflows. If it is proved that the FDI inflows have a significant positive impact on the productivity of domestic firms, FDI inflows must be encouraged. By attracting more FDI inflows, Sri Lankan people may tend to improve their knowledge by experiencing novel technical knowledge which is embedded in relevant organizations. Consequently, it will pave the way for new job creations which ultimately leads to higher productivity in the economy. Hence, it will be a great assistance when making decisions related to FDI inflows.

This study contributes to the scope of FDI in the Sri Lankan context. Since this study is aiming at the relationship between the productivity of domestic firms and long-run / short-run effects with FDI inflows, expected findings will guide relevant parties, when implementing new economic policies related to FDI. Together with that, this research will provide a considerable advantage for the parties who intend on FDI including policy makers, academicians, and future researchers.

2. Theoretical and Empirical Literature

Foreign direct investment can be identified as an investment that is made by a firm or individual in one country into business interests located in another country. As well as, FDI happens when an investor establishes foreign business operations or acquires foreign business assets in a foreign company. When considering FDI, the following theories come along.

Production cycle theory was developed in 1996 to demonstrate certain types of FDI made by US companies in Western Europe after the Second World War in the manufacturing industry by Vernon. Under this theory, he believes that the production cycle consists of four stages namely; innovation, growth, maturity, and decline. As per his theory, innovative products for domestic consumption were created and the surplus was exported at the innovation stage by the U.S. transitional companies. After the Second World War, the demand for those manufactured and exported products by the USA was highly grown in Europe. Consequently, American firms identified the advantage of technology over international opponents and continued exporting (Hendrick, 2017). When the product develops, the technology becomes familiar. As a result of that, European firms began to imitate American products which the U.S. firms exported. Thereby, to maintain the market shares of U.S. companies in relevant areas, they were compelled to perform production facilities on the domestic markets. Accordingly, the production cycle theory of Vernon pronounced certain types of investments made by U.S. companies in Europe Western from 1950 to 1970 and the areas where Americans did not possess the technological advantage and FDI within that period.

Theory of Exchange Rates on Imperfect Capital Markets

At the very first age, foreign exchange risk has been inspected from the viewpoint of international trade (Cushman, 1986). In his study, the influence of uncertainty has been analyzed as a factor of FDI. Similarly, he has explored that foreign currency appreciation has decreased American FDI when the real exchange rate growth stimulated FDI made by USD. Eventually, he has shown that the dollar appreciation has directed to depletion by 25% in U.S FDI. Nevertheless, it is said that currency rate risk theory fails to explain concurrent FDI

between countries with various currencies. The argument arises that such investments are made at various times even so there are adequate cases that oppose these claims.

The Internalization Theory

Originally, Coase (1937) in a national context and Hymer (1976) in an international context established this theory. Then the theory was further developed by Buckley and Casson (1976) and then by Hennart (1982). This theory attempts to elaborate on the growth of transitional companies and their inspiration towards FDI. Hymer (1960) in his doctoral dissertation has identified the removal of competition and the advantages firms possessing in a particular activity as two major determinants of FDI. According to Buckley and Casson (1976), this theory signifies, intending to develop peculiar advantages, transitional companies are maintaining their internal activities. Dunning (2003), who employed the internalization theory even in the eclectic theory, argues that only a part of FDI is explained through this theory (Buckley, 2020).

Hennart (1982) developed models between vertical integration and horizontal integration and convince the idea of internalization to the literature. Hymer the author who developed the concept of firm-specific advantages illustrates that FDI happens only if the advantages of exploiting firm-specific advantages exceed abroad operations cost. As per Hymer's findings (1976) deviation happens within the perfect competition in the final product market which is also known as market imperfection paved the way to emerge multinational enterprises (MNE). Hence, he has discussed some problems such as information cost for foreign firms against local firms, the government's numerous treatments, and currency risk. After studying his results, he concludes that FDI is a firm-level strategy neither capital market nor financial decision (Buckley, 2018).

The Eclectic Paradigm of Dunning

With a mix of three different theories of FDI (O-L-I), Dunning (2000) has developed the eclectic theory. "O" – Ownership advantages; this component is all about intangible assets. This refers at least for a while exclusive possesses of the company and may be transferred within transitional companies at a low cost and as a result of that either to increase income or decrease cost. "L" – Location; after fulfilling the first condition, it is more benefitted a company to own them to use them itself despite selling them or renting them to foreign firms. When determining host countries, location plays a vital role. According to Hanson (2001), specific benefits that a country can reap from location have been divided into three as economic benefit, political advantages and social advantages. "I" – Internalization; when the above two conditions are fulfilled, a company can generate profits at least utilizing some

factors from outside of the origin country. Simply, a firm tends to attract foreign production itself despite of the license right to do so when the net benefits of internalizing cross-border intermediate product market go higher.

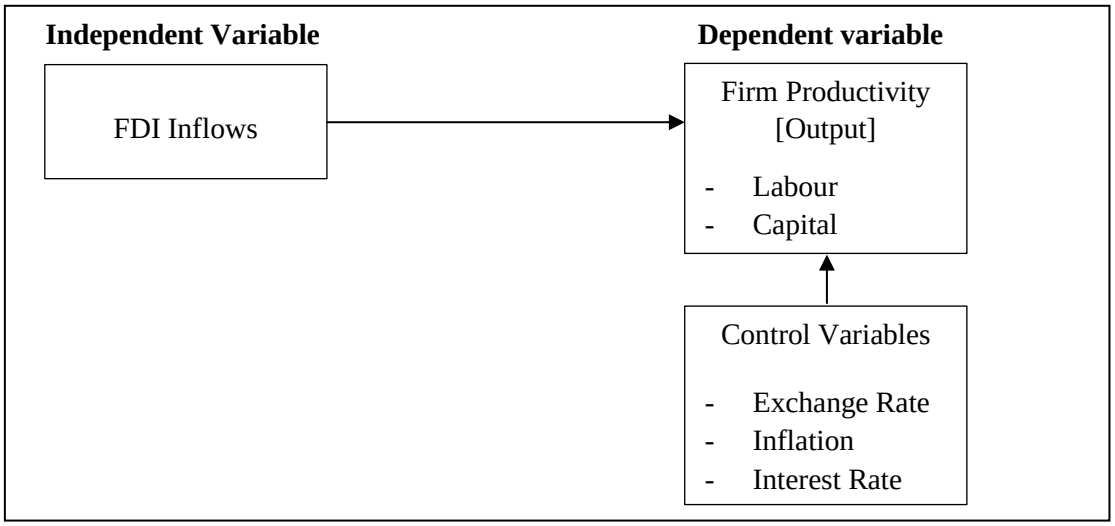
This section is related to the studies including foreign direct investment inflows and domestic firm productivity. According to Ietto-Gillies (2012) the reasons behind FDI and multinational enterprises were demonstrated by neoclassical economics based on macro-economic principles prior to Stephen Hymer's theory related to direct investment in the 1960s. Hymer has stated that FDI is not about the transfer of capital, it could be even supplied to local firms with the help of other international financing ways and means. As well as, the theory has emphasized that FDI is about the international transfer of proprietary and intangible assets such as technology, business techniques and skilled personnel. Moreover, Hymer has pronounced that the existence of FDI is exclusively because of the imperfection of the international markets for these assets (Hymer, 1960).

Furthermore, there are some studies that have examined the impact of FDI on the productivity of domestic firms. Zhou, Li and David (2002) have found that FDI deploys a different impact on firms at the regional level than it does on firms at the industrial level. Simply, they highlighted that the domestic firms in regions that attract more FDI or have a long history of FDI tend to have higher productivity while domestic firms in industries that have more FDI or have a long history of FDI tend to have lower productivity. They have found that FDI inflows have played a positive role in raising the labour productivity of China's key sectors. Moreover, they emphasized by grounding the theory of FDI, multinational enterprises not only transfer capital but also managerial skills and advanced technologies. Consequently, the authors demonstrated that the attracted foreign investments have resulted positively in a beneficial and productive way (Buckley et. al., 2010).

After diving in to the literature, it convinces that there are some studies that focus on firm productivity and FDI. However, when it comes to the Sri Lankan context, there are only a handful of researches that have been conducted in the area of FDI. Most of them are about determinants of FDI. The researcher has identified this literature gap in prevailing literature and expects that this study will pave the way to fill the existing literature gap relevant to the current research topic.

3. Methodology

Based on the literature review and pre-determined research objectives, the following conceptual framework will be considered for this study.



Source: Developed by authors

Even though the conceptual framework shows a diagrammatic representation of the selected variables, in this section it is discussed in detail the variables which are selected for the study.

Firms' Productivity / Output - The study has employed "output" as the dependent variable which represents the productivity of a firm or a company and that has been used by most of the researchers as their dependent variable as well (Oloyede, 2014; Akulava & Vakhitova, 2010; Smarzynska, 2004). Cobb-Douglas production function was used to determine the output. Therefore, the output has been adjusted with the capital and labour of each selected manufacturing company.

FDI - Align with the purpose of the study, Foreign Direct Investment inflow has been taken as the main independent variable of this study. According to the explanation given on the Production Cycle Theory of Vernon, he has pronounced the relationship between FDI and the manufacturing industry. Furthermore, Konings (2001) has found in his study, there may be a spillover that has been generated by FDI to local firms. Consequently, being grounded by theories and being used by many numbers of researchers in their studies, the researcher has selected FDI as the main independent variable in the study.

Exchange rate, Inflation and Interest rate - To uplift the accuracy of the model and based on previous literature, three controlling variables were selected namely exchange rate, inflation, and interest rate (Oloyede, 2014; Sultanuzzaman et al., 2018). Simply exchange rate refers to the rate at which one currency will be exchanged for another currency (Wikipedia, 2021). USD vs LKR has been used as the proxy for the exchange rate. Inflation can be identified as the rate at which the value of the currency falls and as a result the general level of prices for goods and services rises (Fernando, 2021). Changes happen in the Colombo Consumer Price index were used as the proxy for inflation. From time-to-time Central Bank

will impose the treasury bill rate for the trading of bills. Considering the short-term fluctuations, three months treasury bill rate was used as the proxy for the interest rate for this study.

Operationalization provides a spirit of details on the variables which have been used for the study with the aim of achieving the pre-determined objective of the study.

Table 1: Operationalization

Variable	Notation	Measurement	Source
Foreign Direct Investment Inflows	FDI	Annual FDI inflows (USD)	World bank
Exchange rate	EXR	Annual rate of USD vs. LKR	
Inflation rate	INF	Annual inflation rate	
Interest rate	TBILL	3 months Treasury bill rate	
Firm output	Y	Cobb-Douglas Production function (LKR)	Annual reports of companies

The study follows a quantitative and deductive approach since the study has been focused on developing hypotheses based on existing theories. It begins with prevailing theories and make confirmations by observing the developed hypotheses. Furthermore, secondary data is used to conduct the study and panel data regression analysis and Johansen cointegration test have been used for the analysis of collected data.

The population of the study refers to a set of similar items, events or components which is of interest for some experiment (Wikipedia, 2021). Since the study is on the manufacturing sector in Sri Lanka, the population of this study can be identified as listed manufacturing companies in Colombo Stock Exchange (CSE).

The technique of obtaining a sample originated, due to some limitations including time and money that researchers faced when studying the whole population. Accordingly, even in this study the researcher faced some difficult situations such as limitations of accessibility, unavailability of data, time constraints, money constraints and so on when trying to gather the required data. Due to the above reasons, the researcher has to select only 10 companies out of 31 listed companies in CSE and under purposive sampling. The selected companies are as follows.

01	ACL Cables PLC	06	ACL Plastics PLC
02	ACME Printing and Packaging PLC	07	Central Industries PLC
03	Chevron Lubricant Lanka PLC	08	Kelani Cables PLC
04	Lanka Aluminum Industries PLC	09	Lanka Ceramic PLC
05	Piramal Glass Ceylon PLC	10	Royal Ceramics Lanka PLC

A secondary data set has been used for the study. World data bank (from 2010 - 2019) has been taken as a data source for FDI inflows, exchange rate, inflation rate and interest rate. Annual reports of selected manufacturing companies (from 2010 - 2019) were taken to derive relevant outputs using the Cobb-Douglas production function.

Accordingly, panel data was used for the purpose of this study. Since the variables had different measurement units such as billions, points, smaller figures and so on, a natural logarithm was employed to remove effects when they are being analyzed together. These analytical methods have been used by previous researchers who have conducted studies regarding the same area (Saidharan & Ramanathan, 2007; Marcin, 2008; Smarzynska, 2004). Further, Johansen co-integrating test was applied to explore the cointegrating relationship.

When deriving output for selected manufacturing companies, the researcher has employed the Cobb-Douglas production function. Briefly the Cobb-Douglas production function is a particular functional form of the production function, widely used to represent the technological relationship between the amounts of two or more inputs (labor and capital) and the amounts of output that can be produced by those inputs (Wikipedia, 2021). The Cobb-Douglas production function is mentioned below.

$$Y = AK^{\alpha} L^{\beta}$$

Where, Y is the total production, A is the total factor production, K is the value of capital input, α is the output elasticity of capital, L is the labor input and β is the output elasticity of labor.

To find out α and β, the researcher has taken the total value derived from the production process of relevant manufacturing companies as the total production, the total value of fixed assets as the value of capital input, and personnel or staff cost as the labor input. After converting those into natural logarithm, the value of α and β has been derived for each year using excel regression data analysis. The intercept value given from the above output has been applied to another formula to calculate the value of A for each end of every company in a selected 10 years period of time.

$$A = e^{x}$$

Where, A is the total factor production, *e* is the exponential constant (2.718) and *x* is the intercept derived from the data analysis regression output in each year. Finally, all calculated values were applied to the Cobb-Douglas production function and derived relevant output values for selected manufacturing companies (Dobra, 2020; Gmaz, 2014).

As per the literature, there are some studies that have examined the impact of FDI on the productivity of domestic firms. Zhou, Li & David (2002) have found that FDI deploys a different impact on firms at the regional level than it does on firms at the industrial level. Simply, they highlighted that the domestic firms in regions that attract more FDI or have a long history of FDI tend to have higher productivity while domestic firms in industries that have more FDI or have a long history of FDI tend to have lower productivity (Zhou, Li & David, 2002). In the study "The impact of FDI on the productivity of China's automotive industry", the authors have found that FDI inflows have played a positive role in raising the labour productivity of China's key sectors.

Accordingly, the following hypotheses have been developed for this study.

Hypothesis 01

H_0; There is no significant impact of FDI inflows on the productivity of domestic firms of the manufacturing sector in Sri Lanka vs. H_1; There is a significant impact of FDI inflows on the productivity of domestic firms of the manufacturing sector in Sri Lanka

Hypothesis 02

H_0; There is no long-run / short-run relationship between FDI inflows and productivity of domestic firms in the manufacturing sector in Sri Lanka vs. H_1; There is a significant long-run / short-run relationship between FDI inflows and productivity of domestic firms of the manufacturing sector in Sri Lanka

The model for the study has been developed by the researcher based on previous literature.

$$Y_{it} = \alpha_0 + \alpha_1 FDI_{it} + \alpha_2 INF_{it} + \alpha_3 EXR_{it} + \alpha_4 TBILL_{it} + U_{it}$$

Where, "Y" is the firm output, "FDI" is the foreign direct investment, "INF" is the inflation rate, "EXR" is the exchange rate, "TBILL" is the interest rate, "α" is the coefficients of each variable, "i" is the firm, "t" is the time and "U" is the Error term.

4. Results and Discussion

Descriptive statistics

Descriptive statistics are brief descriptive coefficients that summarize a given data set which can be either a representation of the entire population or a sample of a population. Utterly, descriptive statistics split into two parts as measures of central tendency and measures of variability respectively.

Table 2: Descriptive statistics

Variable	Mean	Median	Maximum	Minimum	Std. Dev.
Y	21.4156	21.3015	23.2948	19.9228	0.7228
INF	0.0517	0.0509	0.0770	0.0214	0.0195
TBILL	5.1324	5.0883	7.7041	2.1350	1.9865
EXR	138.6600	133.2500	178.7000	110.6000	20.4153
FDI	9.1231	9.1480	1.6140	4.7756	3.1221

Note: Y = firm output, INF = inflation rate, TBILL = interest rate, EXR = exchange rate, and FDI = foreign direct investment

The above table provides a descriptive statistic of the variable used in the study over the period from 2010 to 2019. The key descriptive measures are the mean and standard deviation. The mean value of output is 21.4156 and the maximum value shown among the period in output is 23.2948 while the minimum is 19.9228. The main independent variable FDI shows a mean value of 9.1231.

Correlation analysis

Correlation analysis attempts to measure the strengths of the relationship and the direction between two variables by means of a single number called a correlation coefficient. This coefficient will lie in the range of +1 to -1. When this coefficient is zero, it indicates that there is no linear correlation between independent and dependent variables but it is possible to have a relationship that is not linear. +1 implies a perfect positive correlation whilst -1 implies a perfect negative correlation. If the correlation coefficient is closer to zero, the correlation between those two variables becomes weaker in spite of direction.

Table 3: Test of correlation

Variable	LNY	LNINF	LNFDI	LNEXR
LNINF	-0.105346			
LNFDI	0.059409	-0.064320		
LNEXR	0.231947	-0.523062	0.200501	
LNTBILL	-0.111594	0.997583	-0.037615	-0.558470

As per the above-mentioned table, both LNINF (Natural log of inflation) and LNTBILL (Natural log of Treasury bill rate) have a negative correlation with output and other variables that show a positive correlation with output. It implies that, when the LNINF and LNTBILL go up, LNY goes down. On that other hand, when the LNFDI, and LNEXR go up, LNY also goes up.

Panel unit root test

Since the researcher needs more accurate results, a panel unit root test was conducted to test the stationarity as follows.

Table 4: Panel unit root test

Null hypothesis : Variable has a unit root			
Variable	Level I(0)	1st difference I(1)	Order of integration
LNY	0.0955	0.0000	I(1)
LNINF	0.0008	0.0000	I(0)
LNFDI	0.0000	0.0000	I(0)
LNEXR	0.0023	0.0000	I(0)
LNTBILL	0.0011	0.0000	I(0)

According to the above table, the following hypotheses were tested.

H_0 – Variable has a unit root vs. H_1 – variable has no unit root

As the table shows, all other variables rather than LNY are stationary at level.

Regression Analysis

Predominantly, panel data refers to a type of data having observations of different phenomena collected over a different period for the same group of individuals, firms or countries. Thus, panel data refers to multidimensional data collected over a period of time. Therefore, panel data can be identified even as a combination of cross-sectional and time series data. Accordingly, panel data models describe individual behavior both across time and across individuals. Pooled Ordinary Least Square model (POLS), Fixed Effects Model (FEM), and Random Effect Model (REM) are the three types of regression models that can be identified under panel data models. Then the notable step appears to identify the most appropriate regression model for the study. Hence, the researcher has conducted redundant fixed effect likelihood ratio (F-test), Breusch-Pagan LM test and Hausman test to identify the most appropriate regression model.

Table 5: Specification test

Specification test	Statistic	P-value	Tested	Selection
Breusch-Pagan LM test	103.0740	0.0000	POLS vs Random	Random
F-test	148.8068	0.0000	POLS vs Fixed	Fixed
Hausman test	0.0000	0.0045	Fixed vs Random	Fixed

Initially, the researcher conducted F-test by using the redundant fixed effects-likelihood ratio. The redundant fixed effects-likelihood ratio is an efficient estimator between the pooled least squares model and the fixed-effects model. It is used to determine the most suitable model between the fixed effects model and POLS. When the p-value is less than 0.05 then the null hypothesis should be rejected whilst the alternative hypothesis should be accepted. The hypothesis to be tested is given below.

H_0: Pooled OLS Model is the most appropriate than the Fixed Effect Model vs. H_1: Fixed Effect Model is the most appropriate than the Pooled OLS Model.

According to the result of the F-test, the most appropriate model is the fixed effect model. Thus, the null hypothesis should be rejected and the alternative hypothesis should be accepted.

H_0: Pooled OLS Model is the most appropriate than the Random Effect Model vs. H_1: Random Effect Model is the most appropriate than Pooled OLS Model.

In, the Breusch-Pagan LM test, the null hypothesis should be rejected if the p-value is less than 0.05. Since the p-value is less than 0.05, the alternative hypothesis should be accepted.

In the Hausman test, the null hypothesis should be rejected if the p-value is less than 0.05. Since the p-value is less than 0.05, the alternative hypothesis should be accepted

H_0: Random Effect Model is the best-fitted model vs. H_1: Fixed Effect Model is the best-fitted model.

Consequently, the Hausman test resulted in the Fixed Effect Model to investigate the impact of FDI inflows on the productivity of domestic firms in the manufacturing sector in Sri Lanka as the most appropriate panel data regression model.

Table 6: Fixed Effect Model

Variable	Coefficient	Std. Error	Probability
LNFDI	0.07984	0.08285	0.0021
LNINF	-1.17205	1.01769	0.2724
LNTBILL	1.22262	1.02824	0.0321
LNEXR	1.59204	0.26186	0.0044
C	6.54322	1.38756	0.0089
R-Squared			0.9453
Adjusted R Squared			0.9370

As per the above result, all variables other than LNINF are significant at the 5% confidence level. Studying coefficient direction, LNEXR, LNTBILL, and LNFDI show a positive relationship with the LNY.

With the use of the above coefficients, the following model can be developed.

$LNY_{it} = 6.5432 + 0.0798\ LNFDI_{it} - 1.1721\ LNINF_{it} + 1.5920\ LNEXR_{it} + 1.2226\ LNTBILL_{it} + U_{it}$

Panel Co-integration

To observe the long-run relationship among variables the researcher conducted a panel data cointegration test.

Table 7: Panel Cointegration

Description	Statistic Probability	Weighted Statistic Probability
Panel V statistic	0.9369	0.9745
Panel rho statistic	0.9875	0.9932
Panel PP statistic	0.0006	0.0000
Panel ADF statistic	0.4700	0.0259
Group rho statistic	0.9999	
Group PP statistic	0.0000	
Group ADF statistic	0.1927	

The Table shows 11 outcomes under two scenarios called panel and group. The hypotheses to be tested under this test are as follows.

H_0: There is no cointegration among variables vs. H_1: There is cointegration among variables

According to the outcome of Table 6, it is clear that there is no enough evidence to accept the alternative hypothesis. Hence null hypothesis was accepted saying that there is no cointegration among variables. Out of 11 outcomes found for group and panel only 03 outcomes (Panel PP and Group PP) are less than 0.05. It means the majority (Group and Panel rho and ADF) are more than 0.05.

5. Conclusion

The main objective of this study was to examine whether the FDI inflows matter the productivity of domestic firms in the Sri Lankan manufacturing sector. As a developing country, Sri Lanka must pay much attention to the area of FDI inflows and then Sri Lankan people may tend to improve their knowledge by experiencing novel technical knowledge which is embedded in relevant organizations.

As per the results of the study the researcher was able to explore the pre-determined objectives of the study. The first objective was to investigate the impact of FDI inflows on the productivity of domestic firms in the manufacturing sector in Sri Lanka. Using panel data, the researcher found the best model as a fixed effect model for the study. Subsequently, FDI showed a positive impact on the output with a coefficient of 0.0798. Furthermore, the developed model showed a 94.53% accuracy level by R-squared. The second objective was about the long-run/short-run relationship between FDI inflows and firm output. Panel cointegration was used to achieve that objective. Since the majority of outcomes (08 out of 11) were more than 0.05, the null hypothesis was accepted which implied that there was no cointegration between variables. In other words, there was no long-run relationship among variables.

The researcher believes that the expected findings will guide relevant parties when implementing new economic policies related to FDI. Together with that, this research will provide a considerable advantage for the parties who are intent on FDI including policy makers, academicians, future researchers and so on. Finally, the existing literature is not sufficient in the Sri Lankan context related to FDI. However, the study overcomes that limitation by adopting a foreign context into Sri Lankan context. Thus, this research motivates potential researchers to study more on the related topic and this will be an attempt to fill the identified literature gap.

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CHAPTER FIVE

Impact of Corporate Governance Characteristics on Forward-Looking Disclosures in Integrated Reports of Listed Companies in Sri Lanka

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Abstract

The purpose of this paper is to identify the nature and extent of forward-looking disclosures (FLD) in integrated reporting (IR) and the impact of corporate governance characteristics on forward-looking disclosures in integrated reports of listed companies in Sri Lanka. The study used structured content analysis based on a forward-looking disclosure index developed on the International Integrated Reporting Framework (IIRF) and a quantitative research approach. Descriptive statistics, Correlation, and Panel Data regression were performed to achieve the research objectives. Findings revealed that the companies provide less forward-looking information concerning the content elements of IIRF. However, these forward-looking disclosures have shown an increasing trend over time. This study further revealed that corporate governance has a significant relationship with forward-looking disclosures in integrated reports. Additionally, it is identified that board composition and board expertise have positively impacted the extent of forward-looking disclosures in these companies while board size, audit committee size, independence of the audit committee, and audit committee expertise were negatively associated with forward-looking disclosure level. Due to the identified dearth of research on forward-looking disclosures in integrated reports in general and particularly in developing countries like Sri Lanka, the findings would provide insights for policymakers and practitioners concerning forward-looking disclosure practices in companies that prepare integrated reports and the need to establish specific guidelines in this respect.

Keywords: *Corporate Governance Characteristics, Forward-Looking Disclosures Index, International Integrated Reporting Framework, Panel Data Regression.*

1. Introduction

The demand of the stakeholders in the last couple of decades has increased considerably for information on the environment, social, non–financial, and governance. This information, like financial information, was critical. However, the weaknesses in financial reporting and sustainability reporting systems have led to a need for a better way to report corporations. This led primarily to developing integrated reporting as a new corporate reporting dimension. To improve management efficiency and decision-making on investments, integrated reporting is an attempt to make corporate disclosures more effective. Integrated reporting is a more efficient and interconnected corporate reporting methodology that focuses on improving the quality of information available to financial capital providers.

Publicly traded corporations are expected to issue annual financial statements detailing an organization's financial position and corporate governance reports showing the extent of corporate governance practices (Garcia, 2013). Companies also voluntarily publish corporate governance, social and environmental reports as a form of non–financial disclosure of information to increase data transparency and accountability (Oliveira, 2010). Financial reporting, according to investors, attempts to convey relevant information that can aid decision-making. Companies give forward-looking information regarding their expectations, such as cash flows, revenue forecasts, and sales volume. It also includes information about non-financial projections, such as ambiguity in future business operations, evaluation, agency relationships, risk, analysis, and other pertinent information about the company (Aljifri & Hussainey, 2007). This type of data is advantageous since historical data can be used to predict future performance, but it cannot guarantee future outcomes. Therefore, investors must make informed decisions based on valuable future data. Disclosures and measurements based on present and future forecasts are more relevant to investment decision-making than disclosures based on historical metrics, which may be highly trustworthy but lack relevance due to their inability to provide insight into current or future cash flow assumptions. Companies with high-quality corporate governance procedures were more likely to disclose projected information, according to previous research (Wang, 2013); for example, they believe that high corporate governance in a company makes it more likely to provide revenue forecasts. Disclosing forward-looking information in a company's annual report results in more informative reports about future performance.

As a result, forward-looking information has become more relevant for all stakeholders, including future forecasted information on both financial and non–financial statements (Bravo, 2016). Despite companies that publish integrated reports, there is a study on the provision of forward-looking disclosures in integrated reports and forward-looking disclosure determinants that are dearth. Accordingly, Sri Lanka has experienced a rapid spread of integrated reporting. By 2018, the number of companies taking integrated reports grew from 32 to 85 in 2015 in Sri Lanka per the data derived from Colombo Stock Exchange. Although IR has been a compelling choice for Sri Lankan, early adopters, it has been a fashion choice for many late adopters. The researcher identified two main objectives to continue the study as follows.

- To determine the nature and extent of forward-looking disclosures in integrated reports published by listed companies in Sri Lanka.
- To identify the relationship between corporate governance characteristics and the level of forward-looking disclosures provided in integrated reports in listed companies in Sri Lanka.

In this context, this research discusses the essence and scope of forward-looking disclosures (FLD) in integrated reporting (IR) and the effect of providing such details of the corporate governance characteristics. Accordingly, this research was carried out by considering market capitalization in the 50 companies listed on the Colombo Stock Exchange (CSE), excluding financial sector companies such as diversified financials, banks, and insurance companies from 2011 to 2020.

2. Previous Literature

The agency cost theory provides the initial background for the association between corporate governance and the disclosure of forward-looking information. Separate ownership and control automatically create a problem between the principal and agent (Jensen, 1976). At the core of this problem is the issue of information asymmetry due to the privacy of the agent (manager) been higher than the principal (owner) information. The new accounting regulations only recommend minimum disclosure standards that are considered inadequate for efficient reporting decisions to invest. According to Jensen (1976), corporate governance structures, such as corporate boards, independent directors, and institutional investors encourage accountability. Corporate governance can encourage the creation of higher strategies for disclosure that allow managers to communicate the underlying business realities to outside investors. Companies may minimize the asymmetry in information between the principal and agent through more important disclosures such as forward-looking information. Because of its

significance, several countries have started to drawing up corporate governance inside and outside corporate companies.

Signaling theory tends to overview the determinants of forward-looking disclosure. Spence (1973) initially proposed the signaling theory to explain workforce market uncertainty. In this theory, information disclosure can be viewed as a signal to capital markets to reduce information asymmetry, reduce financing costs, and increase corporate value. As a result, signaling theory advises that managers publish a significant amount of information in corporate reports to send specific signals to the reports' potential recipients (Elzahar et al, 2012).

Forward-Looking Disclosures

Non-financial and financial information disclosures in corporate annual reports have attracted the interest of many researchers in both developed and developing countries (Garanina & Dumey, 2017). In addition to the annual report, organizations disclose a variety of information to assist users in making decisions by providing them with valuable connected data that aid in anticipating the future performance of firms. The information in the annual reports of the company should be divided into two categories: forward-looking information and backward-looking information. The disclosure of backward-looking information is information about the company's historical results. On the other hand, forward-looking information refers to forecasted firm performance results such as expected revenues, earnings for the coming year, and anticipated cash flows for the coming year (Aljifri & Hussainey, 2007).

There is a strong possibility of voluntary FLD provision from companies with practical corporate governance activities (Hossain, 2005). In the annual reports of the United Arab Emirates, Aljifri & Hussainey (2007), who studied the determinants of FLD, found that profitability, debt ratio, audit committee size, business type, and firm size have a significant effect on FLD. Similarly, Abeywardana (2016) identified the size of the board, the proportion of independent non–executive directors, and the company's size as the determinants of the FLD. Further, Abed & Najjar (2014) justified that board size, board independence, board gender diversity, board experience, board meetings, audit committee size, audit committee independence, audit committee competence, and several audit committee meetings are variables in corporate governance that significantly affect the provision in FLD.

Integrated Reporting and Forward-Looking Disclosure

Integrated reporting (IR) requires a new, creative approach to existing practices in corporate reporting. It is now gradually used in several nations according to the International Integrated Reporting Framework (IIRF) issued by the International Reporting Council (IIRC). This has

contributed to creating detailed reports to tackle the problem of having information in various reporting types (Gray, 2010). According to IIRC (2013), the integrated report, the output of IR, offers a concise communication on how the policy, governance, success, and prospects of an entity contribute to value creation in the short, medium, and long term, in the sense of its external setting. Financial, manufactured, intellectual, human, social and relationship, and natural capital are the six forms of capital identified by the IIRC framework. The fundamental goal of the integrated report is to increase accountability for those capitals and provide a better understanding of their inter-relatedness and trade-offs (Hossain, 2005).

An integrated report also highlights expected changes over time and provides information about the organization's expectations regarding the external environment in the short, medium, and long term, as well as how it may affect the organization and how it is currently equipped to respond to critical challenges and uncertainties (IIRC, 2013). In essence, the integrated report outlines the short, medium, and long-term possibilities and challenges that may arise and their potential impact on the organization's financial and non-financial performance. Academic scholars have made claims about the benefits of disclosing forward-looking information. First, releasing forward-looking information reduces information asymmetry, which occurs when some entities have confidential information about a company that investors and other stakeholders do not have access to (Uyar & Karamahmutoglu, 2012). Forward-looking statements on future operations, plans, strategies, and financial goals are also helpful in assessing predicted cash flows and a company's future value. Although backward-looking data is insufficient for investors to foresee potential possibilities and hazards forward-looking information is critical in making investment decisions.

3. Methodology

The quantitative approach has been followed since the study explores the relationship between the characteristics of the selected corporate governance and the forward-looking disclosure (FLD) level. The total population of the research was 287 listed companies on Colombo Stock Exchange under 19 GICS industry groups as of 30th September, 2021. The population and sample of the study selected 50 listed companies out of 287 listed companies on Colombo Stock Exchange (CSE) considering market capitalization excluding the financial sector (diversified financials, bank, and insurance companies) that have been selected to prepare consolidated reports for ten consecutive years from 2010 to 2020. The financial sector was excluded because they had a unique corporate governance framework than the other companies. Further, diversified holdings were also excluded to avoid duplicating the same firm as an individually listed firm under the holding company. The diversified holding firms are simply head offices with no business operations. Simultaneously, secondary data was used

in the research. All of the research variables' data was included in the companies' management reports and annual reports.

Table 1: Operationalization

Variable	Measurement
FLDI	The proportion of disclosed items to the total items in the index
BSIZE	Total number of directors on the Board
BINDP	Non-executive directors / Total number of directors on the Board
BEXP	Board expertise / Total number of directors
AUDCSIZE	No. of audit committee members
INDPAC	Non-executive directors / Total number of directors in the audit committee
AUDCEXP	Board expertise / Total number of directors in the audit committee
FSIZE	The natural logarithm of total assets
LEV	Total Liabilities / Total Assets

Source: Constructed by Authors by Reviewing Literature.

An FLD index was adopted to identify the nature and magnitude of FLDs in sample companies' integrated reports. Accordingly, the FLD index includes six IIRF (International Integrated Reporting Framework) – Organizational Overview and External Environment (ORG), Governance (GOV), Business Model (BUS), Risks and Opportunities (RISK), Strategy and Resource Allocation (STR), and Performance (PERF), ignoring two elements because 'Outlook' aspects represent its existence future details and the 'Basis of Preparation' are still historical data. Accordingly, twenty-five knowledge categories were listed within those six areas. Under each group, the integrated reports of sample companies were evaluated by counting the relevant sentences on FLD. After that, an FLD score was determined for each content item of the index for sample companies for the ten-year duration based on the sentence count's natural logarithm.

Analysis Tools

The research data was analyzed using quantitative techniques such as descriptive statistics, correlation analyses, and panel data regression using the Ordinary Least Square method. While analyzing the study's first objective (assessing the nature and extent of FLD), it will evaluate descriptive statistics, including central tendency and dispersion measurements. Correlation and panel data regression analyzes (including the Hausman test for identification of random and fixed effects) supported to achieve of the second objective (examining the relationship between corporate governance characteristics and the level of FLD).

4. Results & Discussion

Descriptive Statistics of Forward-Looking Disclosure Criteria

The descriptive statistics of FLD presented in Table 2 indicate that the mean score of all content elements is relatively low, indicating a low level of forward-looking disclosure level in integrated reports. Of the six content elements of the FLD index, the highest level of FLD was witnessed under 'Organizational overview and external environment (ORG)'. However, the 'Organizational overview and external environment (ORG)' content element's standard deviation was the highest, indicating a greater degree of variability of FLD scores of individual companies. This was followed by content elements – 'Governance', 'Business Model', 'Risk and Opportunities', 'strategy and resource allocation', and 'performance 'in terms of the mean score. The highest standard deviation was reported for 'business model', which indicated a higher degree of variability of individual company scores. The mean score of FLD of the 'strategy and resource allocation' was the lowest among the six content elements but with a low standard deviation, which indicated that all companies have not provided much FLD in this respect. The peculiar characteristic is that in the case of the 'business model' content element, the reported minimum score is 0, which indicated that some companies have not provided any business model forward-looking disclosures.

Table 2: Descriptive Statistics of FLD

FLD Disclosure Criteria	Obs.	Mean	Std. Dev.	Min.	Max.
Organizational Overview and External Environment (ORG)	500	2.442	0.171	1.946	2.639
Governance (GOV)	500	2.086	0.093	1.792	2.197
Business Model (BUS)	500	1.358	0.451	0.000	2.197
Risks and Opportunities (RISK)	500	1.599	0.262	0.693	1.792
Strategy and Resource Allocation (STR)	500	1.272	0.217	0.693	1.386
Performance (PERF)	500	1.931	0.112	0.693	1.945
Forward-Looking Disclosure Index (FLDI)	500	1.193	0.056	-0.004	0.303

*See Appendix A for the sub-criteria for the main dimensions of FLDI included.

Source: Eviews Output.

Relationship between FLD and Corporate Governance Characteristics

The correlation analysis is used to identify the association between corporate governance and forward-looking disclosure level in integrated reports published by listed companies in Sri Lanka. As per the table below (Table 3) BINDP, BEXP, FSIZE, and LEV variables positively correlated with forward-looking disclosure level. However, BSIZE, AUDCSIZE, INDPAC, and AUDCEXP variables negatively correlated with forward-looking disclosure levels. The

value of the Pearson correlation of BSIZE was -0.019 hence there is a low degree of a negative relationship between board size and forward-looking disclosure level in integrated reports. The value of the Pearson correlation of BINDP was 0.224 hence there was a low degree of a positive relationship between board composition and forward-looking disclosure level. The value of the Pearson correlation of BEXP was 0.319 hence there was a low degree of a positive relationship between board expertise and forward-looking disclosure level. The value of the Pearson correlation of AUDCSIZE, INDPAC, and AUDCEXP were -0.089, -0.227, and -0.096 respectively. Hence there was a low degree of a negative relationship between audit committee size, independence of audit committee, and audit committee expertise between forward-looking disclosure levels in integrated reports. In addition, the value of the Pearson correlation of FSIZE and LEV were 0.336 and 0.294. Hence there was a low degree of a positive relationship between firm size and leverage and forward-looking disclosure level in integrated reports of listed companies in Sri Lanka.

Table 3: Correlation Analysis

	FLDI	BSIZE	BINDP	BEXP	AUDSIZE	INDPAC	AUDCEXP	FSIZE	LEV
FLDI	1.00								
BSIZE	-0.02	1.00							
BINDP	0.22	0.11	1.00						
BEXP	0.32	0.19	0.19	1.00					
AUDSIZE	-0.09	0.33	0.27	-0.03	1.00				
INDPAC	-0.23	-0.24	0.13	-0.14	-0.08	1.00			
AUDCEXP	-0.09	0.02	0.21	0.02	0.18	0.22	1.00		
FSIZE	0.34	0.02	0.04	0.01	-0.08	-0.18	-0.19	1.00	
LEV	0.29	-0.21	-0.17	-0.12	-0.23	-0.12	-0.37	0.20	1.00

Source: Eviews Output.

The results of panel data regression analysis implied that there was a significant negative relationship between board size and forward-looking disclosure level. That means the higher the board size, the forward-looking disclosure level is lower in integrated reports published by listed companies. In addition to the above point, the results indicated significant positive relationship between board independence and forward-looking disclosure level. Meaning, the independence of the board is highly impacted by the level of forward-looking disclosure and the level is higher in integrated reports published by listed companies. Further, the analysis implied that there was a significant positive relationship between board expertise and forward-looking disclosure level. That means if the board has accounting and finance proficiency directors, the forward-looking disclosure level is higher in integrated reports published by listed companies.

Further, the results of panel data regression analysis revealed that there was a significant negative relationship between audit committee size, independence of audit committee and audit committee expertise, and forward-looking disclosure level in integrated reports published by listed companies in Sri Lanka. These corporate governance characteristics significantly impacted the forward-looking disclosure level. Nevertheless, many past research findings indicated a significant positive relationship between board committees and audit committees regarding the level of forward-looking disclosures. Mahir (2019) found that corporate governance characteristics -board size, board expertise, independence of audit committee, and audit committee meetings- have positively impacted the extent of FLDs in banking companies. Moreover, Samuel (2020) showed a statistically significant and positive relationship between the proportion of independent directors on a corporate board and firms' disclosure of forward-looking information. He suggested that including more independent directors on corporate boards could improve information disclosure and enhance transparency.

On the contradictory, Elzahar et al (2012), Uyar and Karamahmutoglu (2012), and Abed & Najjar (2014) failed to find a significant effect of board independence on the level of FLD. This insignificant association could result from the effectiveness of independent directors being dependent on the institutional systems and business cultures in which a company operates (Kakabadse et al., 2010).

Table 4: Panel Data Regression (Fixed Effect Model)

Variables	Coefficient	Probability Values
BSIZE	-0.2195*	0.02
BINDP	0.0199*	0.02
BEXP	0.0478*	0.00
AUDCSIZE	-0.0181*	0.00
INDPAC	-0.0232*	0.01
AUDCEXP	-0.0275*	0.00
FSIZE	0.0352*	0.00
LEV	0.0272*	0.01
CONSTANT	-0.5906*	0.00
Prob>chi^2	0.000	
R^2	0.86	
Observation	500	

*P<0.05 (Significant at the 95% confidence Level).

Source: Eviews Output.

5. Conclusion

This study examined the nature and extent of forward-looking disclosures reported by listed companies in Sri Lanka from 2011 to 2020. Simultaneously, this study also examined the extent of FLDs in integrated reports using a forward disclosure index developed based on prior literature on the subject. After that, the relationship between the corporate governance and the level of FLD in integrated reports was examined using correlation and panel data regression analyses. Accordingly, the corporate governance considered board size, board composition, board expertise, audit committee size, independence of the audit committee and audit committee expertise and firm size and leverage as the control variables respectively.

Consequently, this study found that most FLDs are limited and qualitative, and most disclosures relate to the 'organizational overview and external environment (ORG)' of these companies. On the other hand, the least amount of FLD is witnessed concerning the business model. Further, the FLD relating to 'strategy and resource allocation was also limited. The study also found that the degree of FLD fluctuated significantly among the companies that produce integrated reports in this sector. In addition, the board composition (BINDP) and board expertise (BEXP) have a positive and significant effect on the degree of forward-looking disclosure level in integrated reports of listed companies in Sri Lanka. On the other hand, board size (BSIZE), audit committee size (AUDCSIZE), independence of the audit committee (INDPAC), and audit committee expertise (AUDCEXP) have a significant negative impact on the degree of forward-looking disclosure level in integrated reports. This indicates that some corporate governance characteristics play a significant role in the provision of FLD in integrated reports in developing context country's listed companies like Sri Lanka.

After evaluating the findings, regarding the impact of corporate governance on forward-looking disclosures in integrated reports in listed companies in Sri Lanka, future implications could be derived. Accordingly, in the future studies, corporate governance characteristics can be extended further by assessing the relationship between corporate governance on forward-looking disclosures in integrated reports. Therefore, future studies should consider obtaining the views of investors on the adequacy of forward-looking disclosure information made available by firms and how that affects their investment decision-making. Using both primary and secondary data will contribute to and strengthen the empirical literature.

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CHAPTER SIX

Factors Affecting for Adoption of Mobile Applications in Stock Trading: Evidence from Bartleet Religare Securities, Sri Lanka

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Abstract

The stock market plays a crucial role in the growth and development of a robust and competitive economy. The ability to trade securities effectively and efficiently will facilitate investments, promote the efficient allocation of capital, and stimulate long-term economic growth in an economy. Therefore, Sri Lanka needs effective strategies for attracting investors into the stock market, facilitating effective and efficient ways of doing stock transactions other than the traditional modes of stock trade. Therefore, this study investigates the factors affecting for the adoption of mobile applications for stock trading in Sri Lanka with special reference to Bartleet Religare Securities. The relevant primary data for the study were gathered through a questionnaire from 303 investors doing stock trading via mobile applications under Bartleet Religare Securities. The findings elaborate that the perceived usefulness, social influence and trust of the investors have positively impacted the adoption of mobile applications for stock trading. However, perceived risk of the investors has negatively impacted the adoption of mobile applications for stock trading. Further, the trust has become the most positively influential factor. Moreover, the finding of the study will be benefited to Colombo Stock Exchange (CSE), Security Exchange Commission (SEC), and Stock Brokerage Firms in different ways.

Keywords: *Adoption of Mobile applications, Perceived Risk, Perceived Usefulness, Social Influence, Trust.*

1. Introduction

Stock trading is the exchange of a stock or security for money from a seller to a buyer. Equities (stocks or shares) represent ownership in a specific company. In the traditional method, the investor has to do the stock market transactions via a physical platform with the help of the agent of the broker of the brokerage firm or the investor has to connect with the

stockbroker over the phone for advice and to place orders. At present, with the development of advanced technology, investors can do their stock transactions using mobile applications on their mobile phones.

This new type of investment transformed into online stock market trading when online brokerage accounts were introduced. Early days people had no free access to stock market trading other than by going through the brokerage stations, but substantially lower fees and commissions have opened up an increased opportunity for every potential investor. An individual can now browse the Internet and look for stock market information on a webpage in order to make an instant informed decision about an investment. Also, there are various social media platforms such as Facebook, WhatsApp, and Telegram groups which consist of investors in order to share stock market information. These factors helped in the growth of the stock exchange market during the near past. Online stock trading has several advantages, including faster trading speed, improved information transparency, trend prediction based on historical data, and lower operating costs (Wu et al., 2012). It is critical to building a strong and secure infrastructure for users to conduct their online stock trading activity via an online or mobile gateway, and a fast internet connection, if available at a lower cost, can help to boost the digital commerce regime (Srivastava, 2011). However, creating a risk-free and trustworthy trading environment is more important than providing benefits to traders because the stock market is a complex and non-stationary system with uncertainty and noise that is heavily influenced by a variety of factors such as company financial reports, government policies, changes in financial rules, real-time stock price trend, global macroeconomics, fluctuation of foreign stock markets, oil price, and so on (Lee, 2009).

The COVID-19 pandemic has caused significant disruption in the global financial marketplace, with the stock market being one of the most affected sectors (Benignos & Navarro, 2020). Moreover, it was difficult and prohibited to do stock transactions on physical platforms under the health guidelines and government regulations. Therefore, the most suitable, safe and efficient way of doing a stock transaction is using online stock trading mobile applications in such a pandemic period where human interaction and travelling are prohibited. Investors can handle their stock portfolio using their own thumbs.

In Sri Lanka, there are 22 stockbroker firms that gives internet and mobile trading facilities to investors (Cohen et al., 2006). Further, Central Depository System made a program following the CSE digitization strategy to open accounts online in 2020, and more than 4000 online accounts have been opened with a turnover of 10 million (Annual Report CSE, 2020).

According to the annual report of CSE, it is obvious that as an organization, CSE has focused on bringing innovation to its strategy with digitalization as a key focus in strengthening its functions. During the year, they expanded their reach in social media platforms, the Mobile App and CSE website. In 2020, there was a 92% increase in followship compared to 2019. On the other hand, there were 27,179 mobile users in 2020 (Annual Report CSE, 2020). However, in 2019 there were only 11,945 mobile users (Annual Report CSE, 2019). As a percentage, it is a 127.5% increase, and the researcher needs to investigate why the individual investors adopted mobile applications in such a higher percentage and what factors affected to the adoption of mobile applications. Technology has enabled secure and rural users to access services and data efficiently and effectively in stock trading according to the Indian context (Srivastava, 2011).

Therefore, the researcher intends to investigate what factors affect on the adoption of stock trading mobile applications and what sort of relationship and how those factors affect on the adoption of mobile stock trading applications in the Sri Lankan context.

2. Previous Literature

The rapid advancement of technology has altered many aspects. It also impacts economics, such as the development of new business activities (software, hardware, and other electronic systems) that support business, for an online trading system. These developments will positively impact on a country's economy (Aldyan et al., 2019).The development of advanced technology has caused a change in the stock brokerage industry to a greater extent. Similarly, there are many theories related to studying mobile stock trading such as the Technology Acceptance Model (TAM), Theory of Planned Behavior (TPB), Theory of Reasoned Action (TRA), Diffusion of Innovation Theory (DOI), etc.

Perceived Usefulness (PU)

Perceived Usefulness (PU) is the extent to which a person believes using a specific system will improve their job performance (Davis, 1989). PU is an important factor of TAM. TAM was validated in terms of using virtual stock trading as a tool for financial management education (Wu et al., 2012). In the Singapore context, it was found that perceived usefulness added real value to a new system, as well as their trading behavior, are critical determinants of Internet stock trading adoption (Loh & Ong, 1998). When considered mobile stock trading, PU has been found positively impact on attitudes toward mobile stock trading in the Malaysia context (Chong et al., 2021). However, in the Sri Lankan context, since there is no evidence specifically for mobile stock trading, it can be relayed on consumer adoption of mobile banking, and electronic payment systems in Sri Lanka. Since the researcher needs to

investigate the investors' adoption of mobile stock trading, the core objective is to find the factors that affect the adoption of mobile applications specifically for stock trading. Therefore, in the Sri Lankan context, perceived ease of use and PU have been identified as motivators to use online banking (Kumari, 2016). PU had a significant positive influence on mobile banking adoption, consistent with previous research conducted in other countries such as South Africa and Malaysia (Ravichandran et al., 2016). In this research, the researcher will investigate the impact of PU to adopt mobile applications on stock trading.

Social Influence (SI)

Social Influence (SI) is the perceived expectation of others that influences one to perform a specific behavior (Ajzen, 1991). SI has been derived from both the TRA model and the TPB model. Social Influence plays a positive role in explaining entrepreneurs' behavioral intentions to use a computerized accounting system. Also, this suggests that when people have limited experience with information technology, social influence becomes more significant and important (Ravichandran et al., 2016).

Moreover, social factors significantly impact on investors' willingness to use Internet stock trading in the Singapore context (Lee-Partridge & Ho, 2003). Moreover, on the other hand, Investment activities are very personal and individual in the context of Internet stock trading. Although investors may seek advice from their social circles regarding the mode of trading, their decision to trade online appeared to be significantly influenced by social pressure, as evidenced by an insignificant path linking social norms to behavioral intention (Lee-Partridge & Ho, 2003). In mobile stock trading, social influence has positively influenced the adoption of mobile stock trading (Chong et al., 2021). However in Taiwan, subjective norms did not appear to have any effect on the intention to use mobile applications for stock trading (Lee, 2009). Further, it was revealed that although investors may seek opinions on the mode of online trading from their social groups, their decision to trade online appeared insignificantly influenced by social pressure, as indicated by an insignificant path linking social norms to behavioral intention (Lee, 2009).

However, in the Sri Lankan context, since the adoption of mobile stock trading is not yet tested, it can be considered with the adoption of mobile banking and electronic card payment methods since that will make sense about the adoption of new technologies by the individuals. Therefore, in the Sri Lankan context, the perceived social aspect of Internet banking has been found to be the most influential factor explaining the adoption of Internet banking services (Jayasiri & Dharmadasa, 2016). In this research, the researcher aims to investigate the impact

of SI to adopt in mobile applications for stock trading, specifically in the Sri Lankan context, by filling the pertaining literature gap.

Perceived Risk (PR)

Perceived Risk (PR) is the perceptions of a consumer regarding the uncertainty and negative consequences of participating in an activity (Dowling & Staelin, 1994). It is proposed that PR and attitude have a negative relationship (Wessels & Drennan, 2010). Customers who are unsure about the product quality, brand, or online services may be concerned about an unjustified delay in product delivery, providing payment without receiving the product, and other illegal activities and fraud (Ravichandran et al., 2016). Online stock trading implies that to facilitate stock investors' intentions to use online stock trading, securities firms must consider stock investors' technological perceptions and risk perceptions to motivate stock traders to use the online trading service (Susana, 2020). Further, individuals who believe the Internet is safe and trustworthy will have a favorable attitude toward Internet stock trading. The finding of the study concluded in the Taiwan context demonstrates that PR has a more decisive influence on customer decision-making than the other factors. The emergence of PR as a key inhibitor highlights that risk is at the forefront of online stock investors' minds. Many Taiwanese stock investors believe that when they use online trading services, they are vulnerable to identity theft and fraud (Lee, 2009). Therefore, online stock trading brokerage firms should prioritize reducing online stock investors' risk concerns (Lee, 2009). However, surprisingly in the Malaysian context, PR has no significant relationship with the adoption of mobile stock trading and that finding suggests that young Malaysian investors are willing to take risks as risk lovers and are enthusiastic about new technology applications (Chong et al., 2021). Therefore, in the global context, there are different relationship in different contexts.

In the Sri Lankan context, due to the unavailability of articles on mobile stock trading, it can be relied on the adoption of mobile banking and electronic card payment methods because PR is affecting the adoption of mobile applications, whether that is specifically for online trading, online banking or online stock trading. Therefore, security and financial risk have been identified as the most vital factors influencing online banking usage, while PR has been identified as the most important factor influencing online banking usage (Kumari, 2016). In this study, the researcher will investigate the impact of perceived risk on the adoption of mobile applications for stock trading, specifically in the Sri Lankan context, while filling a gap in the literature.

Trust

Trust can be recognized as an essential component of social behavior, particularly when making important decisions (Gefen, 2000). Trust has been widely tested in e-commerce studies to assess consumer behavior and mobile payments. In addition, trust has become an important factor in determining behavioral intention to use online shopping (Hajli et al., 2017). Further, trust has shown a significant relationship to participate in online group buying (Sharma & Klein, 2020).

Regarding the adoption of mobile applications for stock trading, in the Taiwan context, it was discovered that trust is an important cue that influences customers' intentions to trade online (Lee, 2009). Further, the finding is significant for new users particularly who lack confidence in online trading. According to the findings of this study, online trading companies could develop trust-building mechanisms to entice investors to engage in online stock trading (Lee, 2009). Further, in explaining investors' adoption intentions towards mobile applications for stock trading, trust has added significant explanatory power to perceived behavioral control, attitude, and social influence according to the Malaysia context (Chong et al., 2021).

Since there are not enough research studies investigating the adoption of mobile applications for stock trading in Sri Lanka, it can be relied on the studies that investigate the adoption of mobile banking and electronic card payment methods. Therefore, it was found that consumer perception of e-payment systems is found to be significantly influenced by trust in Sri Lanka (Kulathunga & Ekanayake, 2019). The researcher will conduct this study to investigate the impact of trust on the adoption of mobile applications for stock trading in Sri Lanka

3. Methodology

Conceptual Framework

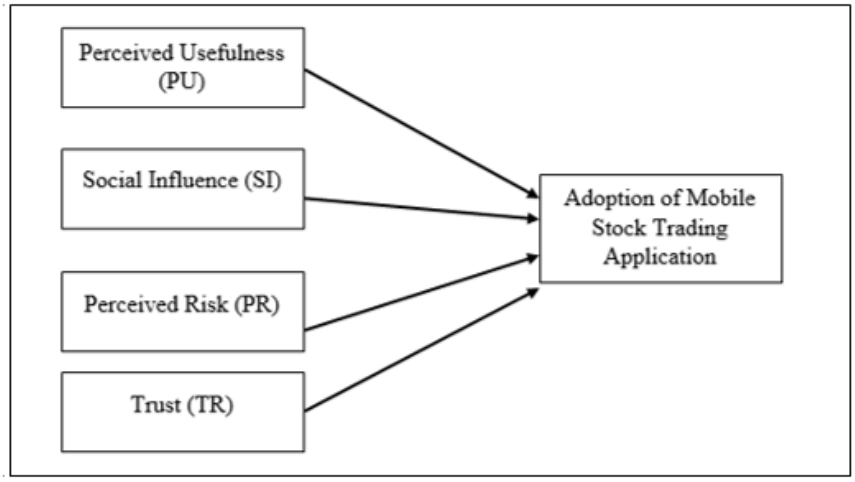

Figure 1 Conceptual framework

Data and Sample

The target population of this study was all the individual investors who invest in Colombo Stock Exchange through Bartleet Religare Securities (BRS). According to the data provided by BRS, there were 3000-4000 individual investors doing mobile stock trading with BRS. The sample size was calculated as 351 according to the Morgan table. The data was gathered via online questionnaires through 351 individual investors doing mobile stock trading under BRS. Three hundred five respondents have accepted the questionnaire out of 351 respondents and 86.32% was the response rate. The researcher continued with the analysis based on 303 respondents. Further, SPSS software was utilized to analyze the research data.

4. Results and Discussion

The current research study has been conducted to investigate the impact of perceived usefulness, social influence, perceived risk and the trust on the adoption of mobile applications for stock trading in Sri Lanka, with special reference to Bartleet Religare Securities.

H1: There is a significant impact of Perceived Usefulness (PU) on the adoption of mobile applications for stock trading in Sri Lanka

Chong et al. (2021) found that perceived usefulness has positively impacted (0.2080) on the intention to use mobile applications for stock trading in the Malaysian context and has been concluded that promoting the resourcefulness of the system will promote the positive intention of the adoption of mobile applications for stock trading. Further, it was discovered that perceived usefulness, and trading behavior, are important determinants of internet stock trading adoption in the Singapore context (Loh & Ong, 1998). In the Sri Lankan context, both the perceived ease of use and perceived usefulness were the most important factors in the TAM model and have been identified as positive motivation factors for user adoption of online banking (Kumari, 2016).

According to the results, the beta value of perceived usefulness is 0.245, which is not equal to zero, and indicated a positive impact in the sample context. The significance value of perceived usefulness is less than 0.05 and indicated a positive impact of perceived usefulness both in the sample and population context as well. Therefore, the hypothesis (H1) has been accepted at a 95% confidence level. Thus, the researcher was confident in concluding that Sri Lankan investors significantly consider the perceived usefulness when adopting mobile applications for stock trading.

H2: There is a significant impact of Social Influence (SI) on the adoption of mobile applications for stock trading in Sri Lanka

Social factors significantly impacted investors' preparedness to use Internet stock trading in the Singapore context (Lee-Partridge & Ho, 2003). Further, that research study explains that investors may consult their social networks for advice on the best trading mode, but an insignificant path connecting social norms to behavioral intention suggests that social pressure greatly influences investors' decisions to trade online (Lee-Partridge & Ho, 2003). In the Malaysian context, social influence has positively impacted on the adoption of mobile stock trading (Chong et al., 2021).

In the study, the Beta value of social influence is 0.171, which is not equal to zero, and that indicated a positive impact in the sample context. The significance value of social influence is less than 0.05 and indicated a positive impact of social influence and can be generalized that there is a positive impact of social influence on the adoption of the mobile applications for stock trading in Sri Lanka at a 95% confidence level.

H3: There is a significant impact of Perceived Risk (PR) on the adoption of mobile applications for stock trading in Sri Lanka

According to Susana (2020), securities firms must take stock investors' perceptions of technology and risk into account to support stock investors' plans to utilize online stock trading. According to the results from Taiwan, perceived risk has a greater impact on customers' decisions than any other element and the fact that the risk is on online stock investors' thoughts at all times is shown by the rise of perceived risk as a significant obstacle (Lee, 2009). According to the findings, the Beta value of perceived risk is -0.165, and the significance value is 0.000, less than 0.05 which indicated a negative impact of perceived risk. Therefore, the hypothesis (H3) has been accepted at a 95% confidence level and can be generalized that perceived risk has a negative impact on the adoption of the mobile applications for stock trading in Sri Lanka.

H4: There is a significant impact of Trust (TR) on the adoption of mobile applications for stock trading in Sri Lanka

In Malaysia, trust has a significant role in promoting the adoption of mobile stock trading, and it also has shown a strong influence on the adoption of mobile applications for stock trading (Chong et al., 2021). Similarly, investors are encouraged by trusted mobile applications to use the mobile applications for stock trading. According to the coefficient table, the Beta value of trust is 0.711 which is not equal to zero, and indicated a positive impact in the sample context. In addition, the significance value of trust is less than 0.05, which indicated a positive impact

of trust both in the sample and population context. Therefore, the hypothesis (H4) has been accepted and can be generalized that trust has a positive impact on the adoption of the mobile applications for stock trading in Sri Lanka.

Therefore, the findings revealed that all the hypotheses were accepted, and the best fitting model for predicting the adoption of mobile applications for stock trading in Sri Lanka can be written as follows based on the multiple linear regression results.

$$AD = 0.415 + 0.245PU + 0.711TR + 0.171SI - 0.165PR + \varepsilon$$

5. Conclusion

The current research study was conducted to investigate the impact of perceived usefulness, social influence, perceived risk and the trust on the adoption of mobile applications for stock trading in Sri Lanka, with special reference to Bartleet Religare Securities. According to the findings, it can be concluded that the perceived usefulness, social influence, perceived risk and the trust impact the adoption of mobile applications for stock trading in Sri Lanka as hypothesized. Therefore, it can be concluded that all the hypothesis were acceptable. Further, the findings explained that perceived usefulness, social influence, and trust has a positive impact on the adoption of mobile applications for stock trading in Sri Lanka, while perceived risk has a negative impact on the adoption of mobile applications for stock trading in Sri Lanka.

The outcome of this research can be used for developing the stock market in Sri Lanka by engaging individual investors in a mobile stock trading platform. Further, CSE, SEC, and stock brokerage firms have the ability to use the finding as their key strategies and core competencies of attracting investors into the stock market as well as policy-making process.

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