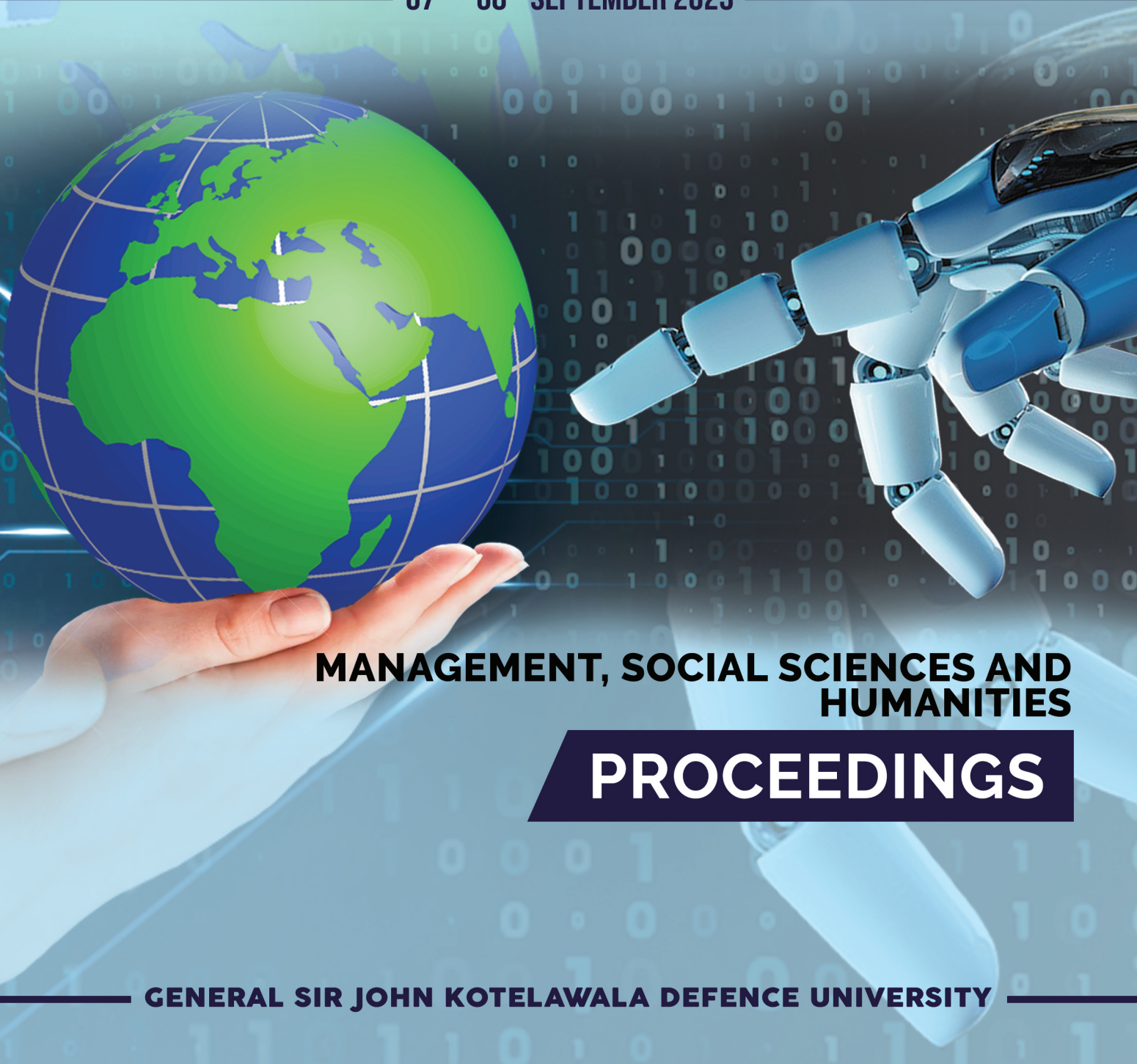




# 16<sup>TH</sup> INTERNATIONAL RESEARCH CONFERENCE

*Achieving Resilience through Digitalization,  
Sustainability and Sectoral Transformation*

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**MANAGEMENT, SOCIAL SCIENCES AND  
HUMANITIES**

**PROCEEDINGS**

**GENERAL SIR JOHN KOTELAWALA DEFENCE UNIVERSITY**

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# The Usage of E-Procurement in Sri Lanka Apparel Supply Chain and its Impact: A Case Study

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**Abstract** - Advances in the supply chain can improve the quality and efficiency of physical, informational, and financial flows. Technical innovation brings significant changes to the structure of connections between vendors, manufacturers, distributors, intermediaries, consumers, and organizations, as well as productivity benefits. Organizations must maintain an effective procurement process to reduce overheads, stay updated on market conditions, and purchase products and services at the best prices. E-Procurement; is a technology that facilitates corporate buying through the Internet. Which offers an organization a bunch of advantages and performance improvements. However, Organizations must overcome obstacles to successfully use E-procurement functions. Even though there has been a lot of research done on e-procurement, the Sri Lankan context was not common. The Apparel sector was chosen as it has been regarded as one of Sri Lanka's most vital industries. This paper focused on the usage of E-procurement and its impact on the development of the industry. Data gathered from industry professionals to inspire medium and small-scale (SME) apparel manufacturers to improve their productivity via E-procurement and to enter the market as well. The article further elaborates on the factors affecting implementation, challenges in usage, and the impact of E-Procurement strategies on the performance of the apparel supply chain. The findings of this research will elaborate the how leading apparel manufacturers have implemented E-procurement and the benefits and challenges they have identified throughout the usage. Also, this article will discuss how to overcome the challenges of E-procurement and how SMEs can inspire to increase their productivity and efficiency.

**Keywords:** *E-procurement, Apparel, Sri Lanka, SME*

## I. INTRODUCTION

The management of physical, informational, and financial flows can be improved in terms of quality and efficiency because of advances in the supply chain. The changes that technical innovation brings about in the structure of connections between vendors, manufacturers, distributors, intermediaries, consumers, and in the strategic decisions of organizations are enormously significant in addition to productivity benefits. Hence, every organization must maintain an effective procurement process in the current, intensely competitive marketplace to reduce overheads, keep engaged in market conditions, and purchase products

and services at the best possible rates for quality, quantity, and time.

### A. What is E-procurement?

E-Procurement is a technological solution that facilitates corporate buying through the Internet. E-procurement implementation offers an organization a bunch of advantages and performance improvements. However, the trail to implementation is filled with obstacles and difficulties that must be overcome for the organization to successfully use E-procurement functions. E-procurement is a term used to describe a digital B2B business process that streamlines and centralizes business operations like the acquisition of goods and services to minimize costs and enhance purchasing procedures (Simfoni, 2023). By automating conventional procurement processes, E-Procurement software eliminates paper-based operations and aids in the analysis of spending for tactical cost-saving activities between finance and procurement. Spend analysis, e-sourcing, e-auctions, procure-to-pay (P2P), marketplaces, and contract administration are all integrated by eProcurement software. The unified method boosts productivity and lowers total procurement costs. A purchasing company's procurement management can greatly benefit from E-procurement, which includes.

#### i. Savings

Built-in technology for cost management and performance improvement assists in minimizing costs and paperwork while boosting productivity. The production and order fulfillment processes can be accelerated by fully automated systems. Additionally, a greater selection of goods and services may be offered.

#### ii. Shorter Purchasing Cycles

Centralized transaction monitoring ensures contract compliance, facilitates reporting on orders, payments, and requisitions, all of which may speed up delivery. On a computer screen, buyers can view the offered goods, services, and prices.

#### iii. Enhanced Inventory Management

Improved inventory control is made possible by procurement experts' quick identification of products from favored vendors and their restriction on the number of purchases they can make.

#### iv. Transparency

All data is consolidated and may be shared with management, stakeholders, shareholders, or the public as needed.

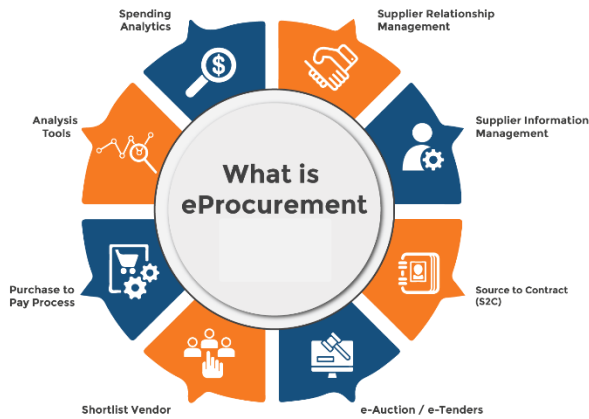


Figure 1: What is E- procurement  
Source: Simfoni (2023)

Various researchers have explored the factors affecting the implementation of E- Procurement in different industries such as Government sector (Premathilaka, 2018), Hospitality, Bank sector and Construction. Among those publications some researchers have highlighted following points as critical success factors which influence the E-procurement implementation within the Organization such as (Shukla, 2016); E-procurement implementation strategy, Ability to adapt changes, Willingness to train and educate, System integration, Performance measurement, Standard of the project, Security and Authentication

According to literature, above factors motivate the implementation of E-procurement, there are also some barriers which desist from implementing E-procurement practices.

*Management barriers-* Resource constraints, Reluctance to change, and information sharing.

*Organization barriers-* Diverse cultures, Compatibility issues both internally and externally, and post-supplier relationships.

*IT barriers-* security, incompatibility, and a lack of standard technologies.

*User barriers-* Fear to change, Lack of information skill system.

The implementation is further hampered by issues with system security, financial consequences, the legal system, and the security of online transactions (Evelyne, 2014).

E-procurement is a complex process with many obstacles to overcome, but when done right, the benefits are unquestionable. The advantages of electronic procurement to organizations have been studied in the literature, some of which are discussed here. Using e-procurement to get contracts helps achieve benefits including greater employee productivity, cost savings via quicker and less expensive delivery of goods and services, increased transparency, and a decrease in employee and manager misconduct in the procurement process. Additionally, e-procurement could promote savings in five other categories, including order costs, administrative costs, lead-time order costs, transactional costs, and opportunity costs of capital (Nasrun, 2016). It is asserted that a business using electronic procurement can reduce costs by 8% to 15% (Shukla, 2016).

The emergence of web-based E-procurement is anticipated to further shorten the time it takes to complete an order, reduce inventory levels, improve order fulfillment, enable more vendor options, standardize effective procurement processes, enable greater control over procurement spending and better employee compliance, provide more readily available Internet options for buyers, and result in less paperwork and repetitive administrative tasks.

It is difficult to find literature that is pertinent to e-procurement and organizational effectiveness. Many businesses fail to recognize how electronic procurement affects organizational effectiveness. It affects performance in both the short and long terms. Rate of return on investment, payback period, profit, and annual income are a few of these effects. In addition to improving process efficiency, e-procurement offers increased leverage opportunities in areas including cost reduction, resource utilization efficiency to boost productivity, and the introduction of new technology, new goods, new processes, and new markets. (Jayawardhena, 2019)

Even though there has been a lot of research done on e-procurement, it was identified that the Sri Lankan context is not common. Most importantly, the Apparel sector was chosen as it has been regarded as one of Sri Lanka's most vital industries. (EDB, 2022)

#### B. Apparel Industry in Sri Lanka

The Apparel and textiles sector in Sri Lanka provides top-notch materials to global apparel brands, helping to clothe the world. Every requirement throughout the world can be met thanks to a wide variety of garment exporters. According to the Sri Lanka Export Development Board (EDB) MAS Active, MAS Intimates, Brandix Apparel Ltd., Hirdaramani International Exports Pvt Ltd, Omega Line Ltd, Eam Maliban Textiles Pvt Ltd, Jay Jay Mills Lanka Pvt Ltd, Bodyline Pvt Ltd, Inqube Global Pvt Ltd. are the major apparel exporters in the country. Sportswear, lingerie, loungewear, bridal wear, workwear, swimwear, and childrenswear are among the categories of Sri Lankan apparel. These goods are produced and exported with the

flexibility to accommodate season in numerous nations throughout the world. The two countries that have historically purchased the most clothing from Sri Lanka are the United States and the United Kingdom. 2022, 46.46% of Sri Lanka's entire export earnings came from the apparel industry. With around 350,000 direct employees and another 2 million indirect jobs, it is the top foreign currency earner and employer. (EDB, 2022)



Figure 2: Export Apparel Destinations  
Source EDB (2022)

This research focuses on the usage of E-procurement and its impact towards the development of the apparel industry. Data gathered from industry professional to inspire medium and small-scale (SME) apparel manufactures to improve their productivity via E-procurement and improve medium and small-scale supplier to enter the market as well. The article further elaborates the factors affecting in implementation of E – Procurement, challenges in usage of E – Procurement and the impact of E – Procurement strategies in performance of apparel supply chain.

Major objectives of the study are;

1. To identify the benefits of E-procurement towards the Apparel industry.
2. To identify impact of E-Procurement on the performance of Apparel supply chain.

## II. METHODOLOGY

Articles from different scientific publication and databases were collected to identify What is E-procurement, Benefits, barriers to implement and essentiality of E-procurement towards the Apparel supply chain. The primary method for gathering data is a survey with a structured questionnaire.

The questionnaire's measurements were created using information gleaned from a literature review. A systematic review has been identified as a fair approach to minimize

biases and random errors which provides a greater transparency of the literature search. The way of gathering relevant literature by using collection of keywords; E-procurement, Apparel, Sri Lanka, SME. Even though there hasn't been much research on the Sri Lankan setting, it was nevertheless possible to design the questionnaire by looking at the research that has been conducted in other countries. The following significant topics were identified from the literature review and the questionnaire was created using the data gathered below. The different types of components which should be included in E-Procurement systems that are typically utilized were thus recognized, and this comprises elements such as electronic catalogues, Online ordering, Online Order tracking, electronic payment, consolidate suppliers and contracts and Centralize control of contracts, product data, catalogues, and price updates for indirect procurement.

The following general advantages can also be obtained by using e-procurement, according to the literature.

- Opportunity to improve relationships with existing and new suppliers.
- Efficient purchasing process
- visibility and transparency to the transactions
- Reduce paperwork.
- Improve Service level.
- Eliminate errors than manual processes.
- Better utilization of human resources in procurement department
- Reduce Procurement Cycle Time
- Increased market share
- Improved customer service levels
- Reduce Purchasing Cost
- Increased efficiency in overall supply chain
- Enhanced Inventory Management
- Improved customer satisfaction

Additionally, research demonstrates that there are common obstacles that businesses must overcome when putting E-procurement into practice. This includes. Unwillingness to adopt e –platforms, Lack of new technological implications in the organization, Lack of motivation of employees, Lack of top management support, Implementation Cost, Resistance, and fear to change to new technology, Security concerns in information exchange and online transactions, Interoperability with existing systems of the organization is difficult and Organizational policies.

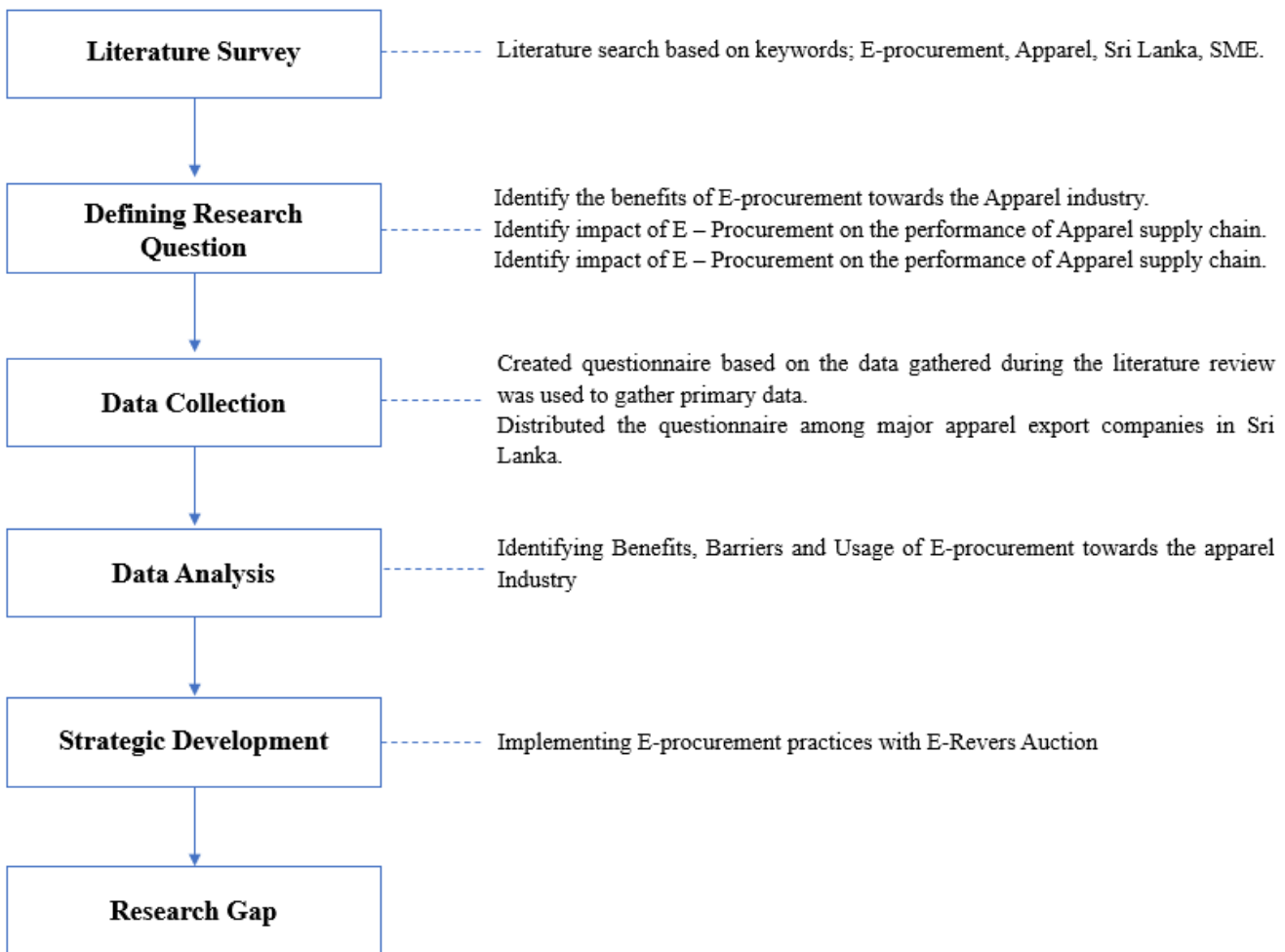


Figure 3: Research Design of the Current Study  
Source: Developed by the Author (2023)

This study follows both quantitative and qualitative approach but mainly the qualitative. As the research strategy, non-probability sampling method with inferential statistics has been selected. An online questionnaire that was created based on the data gathered during the literature review was used to gather primary data. The questionnaire was created to collect data on the three research objectives and to learn more about the industry's background. The questionnaire was distributed among more than 100 employees from leading apparel exporters in Sri Lanka. However, the perception-based data is converted to qualitative analytical approach and Data were presented via descriptive statistical model.

This paper would evaluate that efficiency in Apparel supply chain can be achieved by the advantages obtained from using e-procurement, Further, employee suggestions would be considered to provide suggestions to overcome current procurement related barriers within the organization.

### III. DATA ANALYSIS AND FINDINGS

This study adopts both inferential and descriptive statistics to analyze collected data such as graphical descriptions and statistical generalized commentary based on the results of 50 respondents. Areas focused for this study are employees

those who's working at major apparel export companies in Sri Lanka.

Respondents of this research were in age between 18 – 55 and their designation would be in between Intern to Senior General Manager. Out of them majority of the respondents were in between 18 – 30 whom were either executives or Senior executives. According to them 90% agreed that their organization doesn't follow E-procurement practices within the organization and other 10% of the respondents had some knowledge gap regarding E-procurement practices and Organization Enterprise Resource Planning (ERP) system which didn't act as a E-procurement strategy.

As per the respondents, Majority of the apparel export companies used their procurement practices to;

- Plan and Schedule Orders
- Systematic process to identify procurement requirements.
- Raise purchasing orders via internal System.
- Follow up Supplier.
- Proceed supplier payments.

Meanwhile, Respondents agreed that their current procurement should undergo with below drivers. User Friendly, Less Paper based, Less Human Errors, Efficient & Effective, Enhanced Inventory Management, Reduce Excess Ordering, Decision Making, Value Adding, Shortened Procurement Cycle Times, improved visibility of Supply Chain Management, Raise Purchasing Orders on time.

Further, 50% of the employees were agreed that;

- Inadequate technological infrastructure
- NOT focusing on inventory management
- Incomprehensibility to browse E-marketplace services.
- Complexity of the existing system

Above components are the barriers & limitations of current Procurement system of the Organization.

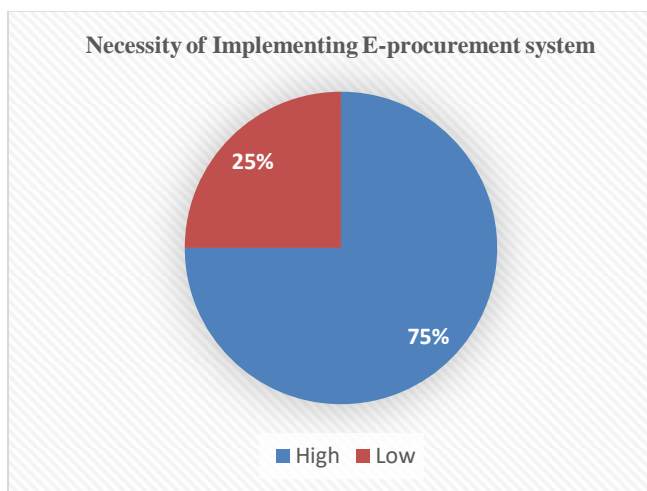


Figure 4: Necessity of Implementing E-Procurement System  
Source: Survey Data (2023)

According to figure 3; 75% respondents thought that there's a necessity of Implementing E-procurement system to overcome the Barriers & Limitations of existing Procurement system.

And they suggested that.

- Accurate data Base
- Access electronic marketplaces
- Online ordering
- Access online catalogue
- Online order tracking
- Achieve cross functional co-ordination.
- Interconnection with supplier

Would be ideal to be included within their procurement process. According to respondents, Majority agreed that; Their supply chain performance has a direct impact with implementing E-procurement strategies within the organization.

#### IV. DISCUSSION

During tabulation of data identified that Apparel Sector required an E-procurement strategies to overcome its own issues such as system complexity, inability of identify the requirement, required to focus on Inventory and inability to browse E-marketplace services. But some of the employees mentioned that there is minimum chance to implement E-procurement since apparel sector is customer nominated business. Anyhow, procurement can be combined with e-Reverse Auction to deal with customer nominated framework by E-procurement.

E-auctions are electronic markets that can be used in B2C and B2B settings. Through a website with a formalized mechanism for setting prices, sellers provide customers with goods or services. In reverse auction, buying organizations post the items that they want to buy and the price, which they intend to pay after evaluating the costing process.

Reverse Auction is used when: There is uncertainty in the size of the market and willingness of the sellers to supply, and there is a large quantity to be purchased and there is clear specification of item or items.

This method functions as a tool for efficient price discovery, complementing the direct negotiation process.

However, Technology may be a great tool for problem solutions when used properly. It offers a sizable tent with a wide range of intriguing possibilities. Businesses and industries should utilize the resources at their fingertips whenever possible. However, companies must locate a piece of technology that matches their operational requirements and budget.

The main aim of this research is to elaborate how leading apparel manufactures has implemented E-procurement and its benefits and challenges they have identified throughout the usage. But during data collecting identified that almost all the organizations were not following E-procurement practices in general. Instead, their procurement practices are based on the own ERP system in the organization. Another limitation was the limited the sample size. Because of the limited sample size, the best E-procurement model fit could not be achieved.

#### V. CONCLUSION

Advances in the supply chain can enhance the quality and efficiency of physical, informational, and financial flows. Technical innovation changes the connections between vendors, manufacturers, distributors, intermediaries, consumers, and organizations, providing productivity benefits. E-Procurement, a technology that facilitates corporate buying through the internet, offers advantages and performance improvements. However, organizations must overcome obstacles to successfully use E-procurement functions. This paper explores the use of E-procurement in the Sri Lankan apparel sector, focusing on medium and small-scale (SME) apparel manufacturers' productivity and market entry. The article discusses factors



affecting implementation, challenges, and the impact of E-procurement strategies on the apparel supply chain performance. The opinions of experienced employees served as the foundation for this study. The outcome would be more accurate and trustworthy if this could be done using precise financial data and other performance metrics rather than constraints. If the research could be expanded with precise data, even as a case study for a single business, it would be more beneficial to the industry.

In addition, the research might be expanded to other possible industries like construction, tea, food manufacturing, hotels, etc. where e-procurement will be valuable in the future. That would encourage those industries to adopt E-procurement.

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# Leadership, Green Human Resource Management and Green Employee Engagement: Navigation of Sri Lanka Navy

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**Abstract** - Corporate and military settings are evolving to be more environmentally conscious. This study aims to bridge the identified empirical research gap through a quantitative study. The identified research gap is that there is no empirical evidence on the mediating effect of Green Human Resource Management (green HRM) on the relationship between leadership and green employee engagement in the Sri Lanka military context and perhaps in the international military context. The research objectives are: to identify the impact of green HRM on green employee engagement; to identify the impact of leadership on green HRM; to identify the impact of leadership on green employee engagement; to identify the mediating effect of green HRM on the relationship between leadership and green employee engagement. This cross-sectional research was carried out in a non-contrived environment under minimal researcher interference. The unit of analysis is individual that is Sri Lanka Navy officers. The sample size is 165. The sample population is 3200. The sampling technique is simple random. The study utilized the Partial Least Squares Regression (PLS) model with SMART PLS 4.0 software to assess the reliability, validity, and relationships among latent variables in both the measurement and structural models. The results reveal that there is a significant partial mediating effect of green HRM on the relationship between leadership and green employee engagement.

**Keywords:** Leadership, Military Context, Green Employee Engagement, Green Human Resource Management

## I. INTRODUCTION

The traditional main roles of military context are war fighting, constabulary, and diplomatic roles. Smit (2018) argues military professionals should be conversant on a variety of environmentally friendly programmes. During peacetime, there is a tendency of the military to concern more about eco-friendliness. This is true for the Sri Lanka Navy context as well. Sri Lanka Navy through their “Blue Green Project” is concerned more about Green Human Resource Management (green HRM) practices. Iddagoda et al., (2023) conducted research on the Sri Lanka Navy’s perception of the mediating role of employee engagement on the relationship between green positioning and employee work performance.

Wong et al., (2003) assert leadership remains inextricably knotted with the military at every level. Wong et al., (2003) further highlight it is important to distinguish between two distinct definitions of military leadership research. The first option is to concentrate on research using military illustrations to test theories that are applicable to a variety of organisations, and the second is to take into account the distinctive features of the military and concentrate on research that tries to understand the identity of leadership within that context. Paunonen et al., (2006) state knowing which individuals will be effective leaders of those in the lower strata of the military’s rigid multi-tiered leadership hierarchy is crucial. In times of war, military leaders are in charge of saving countless lives, and the suffering of people can be greatly impacted by a failure to recognise and remove potentially harmful leaders. Paunonen et al., (2006) further assert that there are probably numerous ways that good leaders differ from bad leaders. Such variations may be observed in temperamental factors or typical personality traits. Davidovitz et al., (2007) state attachment anxiety in leaders was linked to less effective task-oriented leadership and more self-serving leadership motivations. Fry et al., (2005) assert, by encouraging value resemblance across the strategic, empowered team, and individual levels, spiritual leadership results in the development of this sense of leader and follower spiritual survival, resulting in improved levels of company commitment, productivity, and employee happiness. Pearce et al., (2020) assert a leader’s ability to communicate their intentions clearly is necessary for attaining unity of effort. Silva (2016) highlights, it is likely that what is required are leaders with organisational abilities and the capacity to create an agreement. Oppermann et al., (2021) state the Navy needs more leaders who can transform rather than just transact in order to handle the numerous, complex issues of the twenty-first century. Military leadership is the reflection of personality and character to inspire confidence in subordinates that fosters initiative and the acceptance of risk and responsibility (MDSL, 2020).

Human Resource Management (HRM) is the productive utilization of the most valued resource to accomplish the goals of an organization (Opatha, 2019). Therefore, HRM mainly includes all aspects of people management to accomplish desired organizational goals. It is learnt that the term HRM is well-versed with the Sri Lankan and

international community. Iddagoda et al., (2022) state green HRM has become a catchword in management circles due to the whole world moving toward green initiatives. Jabbour and Santos (2008) highlight the assistance of HRM in developing sustainable organisations and therefore the necessity to integrate sustainability with human resource systems. According to Opatha (2013) the term for the majority of Sri Lankans, even academics and HRM experts, ‘green human resource management’ is a fresh idea. Jayasekara et al., (2023) assert, by educating employees about green practices, organisations may increase their environmental engagement in a way that is more sustainable than ever. Green HRM elements are better tools for promoting environmental action among people. There are several definitions for green HRM. According to Arulrajah and Opatha (2016) green HRM is the environmental adaptation of all human resource functions of an organisation at all echelons. Green HRM is the integration of HRM practices within organisational goals of environmental sustainability (Iddagoda et al., 2020). According to Renwick et al., (2013), green HRM is the HRM aspect of environment management. Janadari and Ekanayake (2021) state that organizations are working harder than ever to be more environmentally friendly and they have started attempting to positively influence employees’ thoughts on the subject. Renwick et al., (2013) state, green HRM is a set of HR practices (green training and involvement, green hiring, and green performance and remuneration) aimed at improving environmental performance. Pham et al., (2019) present the green HRM bundle with recruitment, selection, training and development, job description, pay and reward schemes, management of performances, organizational culture, employee involvement and unions’ role in the environment.

Opatha (2019) asserts ‘green’ involves the nature or natural environment. The authors reflect ‘green’ and ‘greening’ as related to the natural environment or nature. The engagement of employees is a product of both behaviour and attitude (Iddagoda et al., 2016). Further Iddagoda et al., (2020) state, there is an evolving trend to safeguard the natural environment or perform duties in relation to greening by military employees. Sri Lanka military comprised of Army, Navy and Air Force is a very significant example of this. Green employee engagement represents the setting up of a responsive employer–employee affiliation by facilitating employees with power to energetically involve in environmental concerns within the organization (Haddock-Millar et al., 2016).

Researchers of the study identified there is an empirical research gap about the mediating effect of green HRM on the affiliation among leadership and green employee engagement in the Sri Lanka military setting and possibly in the international military setting.

1) *Research problem:*

Sri Lanka Navy (SLN) has initiated a ‘Blue and Green Concept (Neela Haritha Sangramaya)’ to address the concerns that the ocean and coastal resources are facing in Sri Lanka. Consequently, SLN has commenced implementing green HRM practices. Therefore, the research problem ‘Is there a mediating effect of green HRM on the relationship between leadership and green employee engagement’.

2) *Research objectives:*

- i. To identify the impact of green HRM on green employee engagement.
- ii. To identify the impact of leadership on green HRM.
- iii. To identify the impact of leadership on green employee engagement.
- iv. To identify the mediating effect of green HRM on the relationship between leadership and green employee engagement.

Figure 1 depicts the conceptual framework of the study.

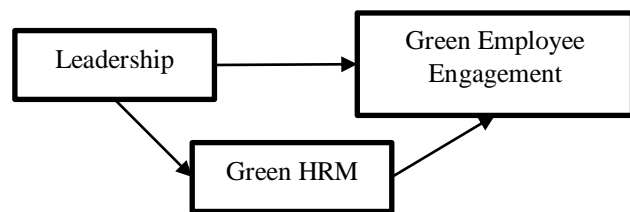


Figure 1. Conceptual framework  
Source: Authors

Wright and Snell (1991) point out that General Systems Theory discusses inputs, process and outputs. Leadership is all about inspiring, guiding and persuading when it is needed. The ‘inspire’ component of the 10 C’s recorded by Seijts and Crim (2006) comprises connect, clarity, contribute, career, convey, congratulate, control, credibility, collaborate and confidence. Employees believe that working as a team with the trust and cooperation of their team members is more efficient than working as an individual or in a team with weak ties, according to Seijts and Crim (2006). As per Wright and Snell (1991) skills are inputs. Therefore, leadership becomes an input. Green recruitment, green induction and green selection are the Green Human Resource Management functions with processes in the view of Pham et al., (2019). In a process, there is a set of activities. Therefore, Green Human Resource Management becomes a process. Output is green employee engagement, which is a blend of green attitudes and behaviours.

3) *Hypotheses:*

H1<sub>a</sub>: Green HRM has an impact on green employee engagement.

H2<sub>a</sub>: Leadership has an impact on green HRM.

H3<sub>a</sub>: Leadership has an impact on green employee engagement.

H4<sub>a</sub>: Green HRM acts as a mediator between the relationship of leadership and green employee engagement.

## II. METHODOLOGY

The purpose of the study is constructed on testing hypotheses. This is a cross-sectional study. The degree of researcher's interference in the study is minimal. The scenario of the research is non-contrived.

The study utilized the Partial Least Squares Regression (PLS) model with SMART PLS 4.0 software to assess the reliability, validity, and relationships among latent variables in both the measurement and structural models. The measurement model ensured the reliability and validity of the observed variables, while the structural model examined the importance of the relationships among the latent variables.

Roscoe (1975), as quoted in Sekaran (2003), presents a rule that the sample sizes must be more than 30 respondents and fewer than 500 respondents. The sampling technique was simple random. Data was collected from a sample of 165 navy officers. The sample population was 3200. The measurement model was weighed for reliability using composite reliability, which evaluates the internal consistency of observed variables. Convergent validity was established by confirming that the Average Variance Extracted (AVE) values for each construct exceeded the recommended threshold of 0.5. Discriminant validity was ensured by employing the Fornell-Larcker measure to compare the square root of AVE values with inter-construct correlations and by calculating Heterotrait-Monotrait (HTMT) ratios. The structural model was analyzed using bootstrapping to evaluate the significance of path coefficients.

## III. RESULTS

Using the techniques suggested by Hair et al., (2019), the evaluation of both the outside (measurement) and inner (structural) models was done in two stages of the analysis. According to Sarstedt et al., (2014), the structural model focuses on the relationships between the latent variables and their observable indicators, while the outer model focuses on the relationships between the latent variables and their dependent and independent latent variables.

To validate the exterior model's reliability and validity, the measurement model was examined initially, encompassing the constructs and their dimensions. The measuring model was initially tested with all 37 indicators incorporated. The factor loadings for all indicators were found to be above 0.4, as indicated in Table 1. Hair et al., (2019) suggested removing factor loadings falling between 0.4 and 0.7 to enhance questionnaire reliability. However, in this study,

removing the remaining factor loadings would not improve reliability, leading to the retention of 28 questionnaire items.

Reliability was confirmed for all constructs, as evidenced by Cronbach's alpha and composite reliability scores exceeding 0.7. Moreover, convergent validity was established, as the average variance extracted for all constructs surpassed 0.5, following the criteria established by Fornell and Larcker (1981).

Subsequently, to ensure discriminant validity, the Fornell and Larcker measure and HTMT ratio were employed. Conferring to these requirements, the HTMT values should be below the 0.9 cutoff and the square root of the average variance retrieved for each construct should be bigger than its maximum correlation with other constructs correspondingly (Henseler et al., 2015). The findings were supported by cross-loading results, conclusively demonstrating discriminant validity.

Table 1. Validity and Reliability of Questionnaire

	GEE	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
GEE10	0.715	0.843	0.847	0.881	0.514
GEE11	0.715				
GEE12	0.708				
GEE2	0.701				
GEE4	0.698				
GEE5	0.777				
GEE6	0.699				
GHRM1	0.756	0.934	0.934	0.944	0.588
GHRM10	0.772				
GHRM11	0.66				
GHRM12	0.506				
GHRM2	0.674				
GHRM3	0.813				
GHRM4	0.863				
GHRM5	0.871				
GHRM6	0.833				
GHRM7	0.793				
GHRM8	0.794				
GHRM9	0.789				
LED1	0.872	0.964	0.965	0.969	0.777
LED2	0.862				
LED3	0.905				
LED4	0.915				
LED5	0.864				
LED6	0.878				
LED7	0.896				
LED8	0.89				
LED9	0.849				

Table 2. Discriminant Validity- Fornell and Larcker Criterion

	GEE	GHRM	LED
GEE	0.717		
GHRM	0.442	0.767	
LED	0.525	0.554	0.881

Table 3. Discriminant Validity - HTMT Ratio

	Heterotrait- monotrait ratio (HTMT)
GHRM <-> GEE	0.465
LED <-> GEE	0.575
LED <-> GHRM	0.57

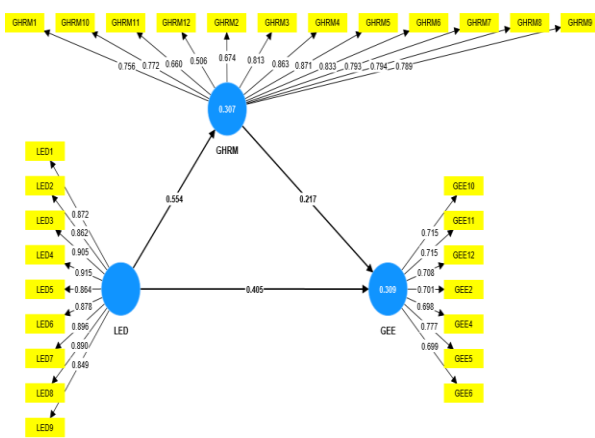


Figure 2. The Structural Model

The above figure illustrates the model. Initially, we evaluated the model with the Variance Inflation Factor to detect any potential multicollinearity. Hair et al., (2019) state in the Partial Least Squares-Structural Equations Modeling setting, Variance Inflation Factor values greater than or equal to 5 suggest the presence of collinearity issues. However, in our study, all constructs displayed Variance Inflation Factor values lower than 5 (refer to Table 4 - Structural Model Results), indicating the absence of multicollinearity.

Subsequently, we proceeded to estimate the path coefficients using the Bootstrap resampling method to assess the significance of direct paths and determine normal errors (Hair et al., 2011). The coefficient of determination (R2 value) for the direct consequence of leadership on green employee engagement was 0.309, while the coefficient of determination for the indirect effect of leadership on green employee engagement, mediated by green HRM, was 0.307. Both R2 values exceeded the 0.10 threshold, confirming the model’s in-sample extrapolative power (Falk and Miller, 1992). Effect sizes were also examined to understand the contributions of predicting variables to the R2 value of endogenous variables. Leadership had a strong effect on green HRM and a

medium effect on Green Employee Engagement, while green HRM had an insignificant effect on green employee engagement. Moreover, green employee engagement predicted green HRM.

To evaluate the model’s predictive power outside the sample, we analyzed the Model’s Stone-Geisser Q2 value (Geisser, 2017; Stone, 1974). A Q2 value greater than zero for any endogenous latent variable in the structural model indicates that the path model aids in predicting the dependent construct. Our estimates of green HRM and green employee engagement yielded Q2 values > 0 (see Table 2, Panel A), confirming the predictive relevance of the exogenous constructs for the endogenous construct.

The findings of Hypotheses tests are presented in Figure 2 and Table 4, Panel B, which display the path coefficients for leadership, green HRM, and green employee engagement. Hypothesis 1 hypothesized that green HRM has an impact on green employee engagement. The results fully supported this hypothesis, as green HRM significantly enhanced green employee engagement ( $\beta = 0.217$ ,  $t = 2.208$ ,  $p < .05$ ). Similarly, Hypothesis 2, predicting leadership has an impact on Green Human Resource Management, was also supported, with leadership significantly increasing Green Human Resource Management ( $\beta = 0.554$ ,  $t = 8.672$ ,  $p < .001$ ). As for Hypothesis 3, which proposed that leadership has an impact on green employee engagement, it was fully supported, with leadership significantly improving green employee engagement ( $\beta = 0.405$ ,  $t = 3.727$ ,  $p < .001$ ). For more detailed results, refer to Table 4, Panel B.

Table 4. Structural Model Results

	Predictive Ability		F Squared		Variance Inflation Factor	
			GEE	GHRM	GEE	GHRM
Panel A	R2	Q2				
Green Employee Engagement	0.309	0.249				
Green HRM	0.307	0.284	0.047		1.442	
Leadership			0.165	0.442	1.442	1
Panel B						
Path-Coefficients	$\beta$	t-statistic	P Value	95% Confidence interval		Support
GHRM -> GEE	0.217	2.208	0.027	0.017	0.402	Yes
LED -> GEE	0.405	3.727	0.000	0.196	0.615	Yes
LED -> GHRM	0.554	8.672	0.000	0.425	0.674	Yes

Hypothesis 4 has found support, indicating that green HRM acts as a mediator between the relationship of leadership and green employee engagement. Table 5 provides further evidence to back this hypothesis. The results demonstrate a noteworthy total effect of leadership on green employee engagement ( $\beta = .525$ ,  $t = 6.877$ ,  $p < .001$ ). When introducing the mediator into the model, the direct effect showed a positive relationship ( $\beta = 0.405$ ,  $t = 3.727$ ,  $p < .001$ ). Additionally, the indirect effect, considering the mediator in the analysis, was also found to be significant ( $\beta = 0.12$ ,  $t = 2.215$ ,  $p < .001$ ). Consequently, the findings advocate that green HRM performs a partial mediator role in the relationship between leadership and employee engagement.

Table 5. Mediation Outcomes

	Coefficient	t-value	Lower	Upper	Mediation
Total Effect	0.525	6.877			
Direct Effect	0.405	3.727			
Indirect effect	0.12	2.215			
Percentile bootstrap 95% CI			0.01	0.226	
LED → GHRM - > GEE					Yes

#### A. Discussion

According to Smit (2018), military personnel should be knowledgeable about a range of green initiatives. During times of peace, the military is increasingly emphasizing environmental responsibility. This also holds true in the context of the Sri Lankan Navy.

The results indicate that the measurement model achieved reliability, discriminant validity and convergent validity ensuring the soundness of the observed variables. These findings provide confidence in the quality of the data used in the subsequent analysis of the structural model. The bootstrapping analysis of the structural model's path coefficients allows for the examination of the significance of these relationships, providing insights into the hypothesized associations among latent variables.

The mediation results suggest that green HRM plays a substantial role in explaining the relationship between leadership and green employee engagement. These findings provide support for the hypothesized mediation model, indicating that the effect of leadership on green employee engagement is partially explained by the presence of green HRM. The mediation effect suggests a

plausible mechanism through which leadership influences green employee engagement, highlighting the importance of green HRM as an intermediate variable in the process.

#### B. Limitations and Further Studies

This will be a cross-sectional study and data will be gathered only on one occasion due to the time constraints of the officers in the Sri Lanka Navy. Green HRM is being practiced in tri forces in Sri Lanka. Therefore, Sri Lanka Army and Air Force can test this conceptual framework with green HRM.

#### IV. CONCLUSION

The identified empirical research gap, i.e. there is no empirical evidence on the mediating effect of green HRM on the relationship among leadership and green employee engagement in the Sri Lanka military setting perhaps in the international military context has been bridged. The military's continued environmental protection initiatives are readily apparent. In this empirical study, a significant partial mediation of green HRM on the relationship between leadership and green employee engagement was revealed. This study indicates when the organization is concerned more about leadership development, it increases green HRM and after that green employee engagement. This study indicates the Sri Lanka Navy should take more initiatives on leadership developmental programmes in order to enhance green HRM. This can be done by reviewing existing leadership development programmes with the identified perceived leadership needs. Thereby analyzing the gaps, suitable leadership development programmes can be designed and developed to achieve the Sri Lanka Navy's desired objectives.

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# Customer's Perspective on Dynamics of Digital Transformation in the Bank Industry of Sri Lanka

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**Abstract** - Digital transformation has changed the entire banking system making it accessible, competitive and improving effectiveness and efficiency. Most local banks in Sri Lanka are now moving towards technology-driven and internet-based banking services. However, in Sri Lanka, relatively little empirical research has been carried out to examine the dynamics of digital transformation. Hence, there is a growing need to identify the relevant customer perspective on the dynamic of digital transformations. Therefore, this research aims to identify and explore factors behind customers' perspectives on the dynamics of digital transformation in the bank industry of Sri Lanka. A general qualitative approach was used with in-depth interviews to achieve the purpose of the research. The research data were analysed using thematic analysis with a combination of theoretically derived themes and indigenous themes from the research findings. Finally, the researcher used both UTAUT and TRA commonly to build an empirically supported model. From the data analysis, the participants cited eleven major themes as answers for the two research questions. Those are fitness for lifestyle, personal image and social standards, maturity of product or service, ease, usefulness, security, social factors, cost and time benefit, and reliability. As implications for bankers, it is found that when launching a marketing campaign for new digital products and services, it is essential to demonstrate the usage of digital technology to increase public awareness. This research helps understand customer perception, and banks can identify more personalized product models to motivate customers to access digital products and services further.

**Keywords:** Banking industry, Customers' perception, Digital transformation

## I. INTRODUCTION

Globally, many banks have made significant investments in digital banking, maintaining a competitive edge by offering a wide range of products and services. Furthermore, the global banking sector is adopting emerging technologies such as open banking, platform banking, electronic onboarding, cryptocurrencies, blockchain, artificial intelligence (AI) and big data analytics. Such technologies generate significant benefits and encourage customers to seek safe and secure banking. Though, research focusing on Digital transformation in other sociocultural contexts is relatively new and limited in number. While the importance of the rapid technological

changes is a heavily researched area, however, on the other hand, Digital transformation is rarely considered when examining the banking industry (Chau & Lai 2003). This study contributes toward filling this gap by focusing on the digital transformation experiences of customers in the banking industry in Sri Lanka.

Digital transformation can be defined as the use of technology to radically improve the performance or reach of enterprises (Westerman, et al. 2011) and digital transformation can be understood as the changes that digital technology causes or influences in all aspects of human life (Kaplan, et al. 2010). The literature shows that digital transformation is highly important to the banking sector and the financial industry (Kaplan, et al. 2010). Hence there are so many digital innovations and services available on the market. According to Salman and Hasim (2014), gender, age, educational qualifications, and location are the salient socio-economic factors influencing whether customers accept new technology and adopt digital banking. Case, Lacey, and Hopkins (1996) further emphasize that technological characteristics such as information intensity, ease of access, data privacy and security are key concerns that affect online banking usage. Moreover, Marshal & Jack (2011) further note that effectiveness and customer confidence about digital channels directly influences the adoption of online banking.

Regarding the number of customers using digital banking, it is high as 30% in developed countries, while in developing countries such as Sri Lanka, it is low as 4% (Sri Lanka 2022). In reality, many consumers are reluctant to use banking-related digital services and facilities. However, there is uncertainty about whether customers can access digital banking services due to the lack of infrastructure and adequate knowledge, limited internet access, data security and privacy requirements and accessibility. Consumer confidence in online banking services directly affects whether consumers use digital banking services. Therefore, in the current digitalization era, the global banking sector is focused on increasing customer bank satisfaction and loyalty by introducing better technology (Salman & Hasim 2014).

Sri Lanka has a robust banking system with 26 banks and six licensed specialized banks with a wide range of bricks

and mortar branch networks. Thus, financial services have significantly penetrated much of the country (Central Bank of Sri Lanka Annual Report 2018). Instead of coming to the bank and using traditional channels, customers will likely use several alternative channels such as mobile apps, point of sale machines (POS), internet payment gateways, e-wallets, and ATMs. The banking sector has made significant progress with the digital system, and many projects are still being implemented in Sri Lanka. Regular citizens in Sri Lanka have a significant level of interaction with banking services. Without proper guidance, people will usually have some setbacks in blending with technology. For this digital transformation to be successful, that setback must be eliminated. A proper study is needed to guide it. In this context, it is essential to explain what influences are there for consumer motivation towards digital banking and why they choose another channel apart from digital banking.

Further, previous research presents the impact of digital business transformation on different industries, though the banking industry was rarely addressed. Moreover, previous research on digital transformation has focused primarily on the benefits of e-service Fields (Salman & Hasim 2014), whereas many studies have been conducted on the specific areas of digitization in the banking industry, but there is a significant lack of studies that discuss the customer and the strategies required for digital transformation in the banking industry. Furthermore, many Studies based on this area have been conducted mostly in developed countries and are quantitative studies. Hence, identifying the customer experience and needs is essential to adhere to these digital transformations in the banking industry. Therefore, this study seeks to answer the research question of how customers adopt or abandon digital transformation and what factors influence adoption to embrace digital transformation.

The remainder of the article is organized to review the previous studies, explain the methodology adopted in conducting the research, present the findings against the literature and finally, conclude the findings of the study.

## II. LITERATURE REVIEW

Digital transformation is a more long-term process. It means the total changes associated with applying digital technologies in all aspects of society. Digital transformation can be understood as the changes that digital technology causes or influences in all aspects of human life” (Kaplan et al. 2010). Lankshear & Knobel (2008) define digital transformation as the third and ultimate level of digital literacy that “is achieved when the digital usages which have been developed enable innovation and creativity and stimulate significant change within the professional or knowledge domain”. This explanation seems to go deeper than others in that it

explores the motivation for and consequences of undergoing digital transformation. Investing in digital business transformation offers new opportunities for organisations by making them able to create new products and services, improve the existing business processes, achieve new levels of business efficiency, personalise the customer experience and decrease the overhead expenses in long-term (Kaplan et al. 2010). In fact, more than 600 out of 1559 surveyed executives studied by Fitzgerald et al. (2013) state that they have already expanded into new markets with the help of digital technology. However, the creation of new businesses and business models with the technology appears to be very rare, as only 7% of respondents to that survey stated that they were able to create new businesses (Fitzgerald et al. 2013).

Digitization in the financial and banking industry has changed from the digital transformation of internal operations and communication to the digital transformation of internal and external processes (Scardovi 2017). Digital transformation is evolving along with customer needs, and banks are developing new solutions and platforms to facilitate their customers. Developing and fulfilling customer needs is almost mandatory for banks and financial actors to achieve better customer satisfaction and compete in the market. The rapidly growing development in IT and technology is not only an opportunity for the actors in the banking and financial industry but also a challenge and risk that these actors are facing and will continue to do so (Scardovi 2017). It depends on each actor in this industry whether to see the technological changes as an opportunity or a challenge. This can also depend on the size of the organisation, resources, the ability to change and other important impacting factors in digital transformation that make it more of a challenge than an opportunity (Amin 2016). The biggest actors in this industry are facing more challenges in the digitisation process than the smaller actors because of legacy systems, hierarchies, and the infrastructure of the organisation (Scardovi 2017). Digital transformation in the banking and financial industry has changed the usability and availability of banking services. Nowadays, it is possible to perform different operations and transactions at any time and place. A key factor which has led to this transformation in the process can be related to the internet banking (Bihari 2011).

With digital innovation in the banking industry, customers are becoming more demanding, forcing firms to focus on service quality to enhance business performance and more convenient services (Pekovic & Rolland 2016). In a service-driven economy like Sri Lanka's, the banking industry is a significant sector that requires appropriate marketing strategies (Dissanayake & Ismail, 2015). With the advancement of technology, the lines separating online and offline services have blurred quickly, and the

traditional methods of depositing money and making payments have changed. Organizations have taken advantage of these changes by developing alternative financial products and services that have allowed them to seize new opportunities in the financial market (Fairouz & Wickramasinghe, 2019).

Early studies mainly focused on potential benefits and security aspects of digital banking in terms of e-banking. Howcroft, Hamilton, & Hewer (2002), further discuss the motives for and barriers to using e-banking or m-banking and the development of digital banking services which replace conventional banking practices. While digital banking will challenge the conventional banking system, it has not completely replaced all the processes (Scardovi 2017). Research reveals that customers tend to use digital banking products and services rather than conventional banking services (Alalwan et al. 2016).

Neumourues barriers have been identified for internet banking, arguing that security, data privacy and customer satisfaction affect uptake (Sarokolaei at al. 2012), while Amin (2016) further discusses service quality and security affecting customs focused on the customer experience. Martins, Oliveira, & Popovič (2014), have revealed that trust and security are the most critical issues, especially amongst non-users who have higher levels of concern, do not have the confidence, and required knowledge to perform financial transactions through online channels and have no intention of adopting internet banking products or services.

Research on consumer attitude and adoption of internet banking showed several factors predetermining the consumer's attitude towards online banking, such as a person's demography, motivation and behaviour towards different banking technologies and individual acceptance of new technology. It has been found that consumers' attitudes toward online banking are influenced by their prior experience with computers and new technology (Laforet & Li 2005). The adoption of electronic banking forces consumers to consider concerns about password integrity, privacy, data encryption, hacking, and the protection of personal information (Benamati & Serva 2007). Electronic banking requires the most consumer involvement, as it requires the consumer to maintain and regularly interact with additional technology (Jane et al. 2004). Consumers who use e-banking use it on an ongoing basis and need to acquire a certain comfort level with the technology to keep using it (Servon & Kaestner 2008). While the studies reviewed here have certainly been informative in terms of revealing the different experiences involved in digitalization in the banking industry, there is little qualitative information available (Scardovi 2017) as to how customers adopt or abandon digital transformation and what factors influence adoption to embrace digital

transformation. Therefore, there remains an opening for theoretical and empirical research in the field of customer experience on digital transformation in the banking industry.

### III. THEORETICAL REVIEW

Previous research during the past two decades has examined factors that motivate consumers towards digital transformation in several contexts. Still, there is limited empirical evidence about understanding consumers in digital transformation. Theoretical models include; The Unified theory of acceptance and use of technology (UTAUT) (Venkatesh at al. 2003), The Theory of Reasoned Action (TRA) (Fishbein & Ajzen 2012), which are discussed in the present study.

UTAUT and its extended theoretical frameworks are very popular and widely used to predict behavioural intention for adopting technology (Venkatesh at al. 2003). which consists of four main concepts, Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), and Facilitating Conditions (FC). These four main concepts are independent variables which influence dependent variables, behaviour and usage (Venkatesh at el. 2003). Performance expectancy (PE) is to be "the degree to which an individual believes that using the system will help him or her to attain gains in job performance" (Venkatesh at al. 2003) and effort expectancy (EE) to be "the degree of ease associated with the use of the system" (Venkatesh at al. 2003). Social influence (SI) means "the degree to which an individual perceives that it is important others believe that he or she should use the new system" ((Venkatesh at al. 2003) whereas facilitating conditions (FC) considered to be "the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system" (Venkatesh at al. 2003). Behavioural intention (BI) refers to the motivational factors that influence a given behaviour where the stronger the intention to perform the behaviour, the more likely the behaviour will be performed (Venkatesh at al. 2003).

The Theory of Reasoned Action was developed by Fishbein & Ajzen (2012) as an improvement over the information integration theory. Fishbein and Ajzen formulated the theory after trying to determine the differences between attitude and behaviour. It is mainly used to predict how individuals will behave based on their pre-existing attitudes and behavioural intentions. Fishbein & Ajzen (2012) further formalized the theory as an explanation of an individual's behaviour as a function of behavioural intention, attitude, subjective norm, and ultimately, beliefs underlying attitude and subjective norm. TRA attempts to predict and explain one's intention of performing a certain behaviour. The theory requires that behaviour be clearly defined in terms of the four concepts:

Action, Target, Context, and Time (Fishbein & Ajzen 2012). To have a clear understanding of behavioural intentions, the theory of reasoned action focuses on a person's attitude towards a behaviour and the subjective norms of influential people and the people around them that could potentially influence those attitudes. Further, behavioural intention is a function of both attitudes and subjective norms toward that behaviour (Miller & Katherine 2005).

#### IV. METHODOLOGY

This study specifically focuses on customers' experience with digitalization in the banking industry, and the qualitative research method was considered the most appropriate. Though there are plenty of quantitative studies in this area, they are unable to provide the real picture of the view of respondents with a questionnaire. In order to understand the real picture, dig deeper into information and contribute literature by exploring context-specific information, researchers have adopted qualitative methodology in carrying out the present study. Therefore, this study is exploratory in nature. Consequently, the research process of this study is inductive. Thus, this study adopts an interpretivism (phenomenological) approach to deeply understand customers' motivations to embrace digital banking products and services in Sri Lanka. This approach is likely to produce new insights into customers' experiences of digital banking products and services by answering the research questions. In line with Mishler (1996), this study adopts the general qualitative research design for case-centred research.

The study was conducted in Sri Lanka because of the researcher's familiarity and exposure to the Sri Lankan environment. Therefore, 12 customers were selected who are involved in digital banking in Colombo District, where the highest population (42.6%) is using digital banking. Among them, 6 people are males, and 6 are females. The researcher interviewed clients using digital banking products and services for less than six months and more than five years. Half (6) of each gender category is new to using digital banking products and services (less than six months), and half (6) are experienced users (more than five years). These two dimensions ensured that data variability was maximized when answering research questions. To protect the interviewees' privacy and identity, pseudonyms were used. Specific pseudonyms are assigned to each participant based on their digital banking experience and gender. Pseudonyms (i.e., MN1, MN2, MN3, FN1, FN2, FN3, ME1, ME2, ME3, FE1, FE2, and FE3) are used in both the interview recordings and transcriptions. Therefore, participants cannot be identified directly from the transcription or any other information. For the above pseudonym codes, MN1, MN2, and MN3 represent males, and FN1, FN2, and FN3 represent females who have used digital products and services for less than six months.

Likewise, ME1, ME2, and ME3 represent males, and FE1, FE2, and FE3 represent females who have used digital products and services for over five years. . The purposive sampling method was used to choose study participants. An extreme group or maximum heterogeneity approach produces an initial potential sample, and the final selection, then, had made a combination approach. The extreme or deviant case sampling approach emphasises cases rich in information because they are unique and stand out.

In-depth interviews for 30 to 45 minutes were carried out with participants in accordance with the suggestion of Myers (2013), which claims that researchers can gain more knowledge and understanding by interviewing individuals to gather in-depth information by identifying a client's perspectives, perceptions, and interactions. The gathered information was examined using thematic analysis. There are numerous ways to conduct a thematic analysis, though most researchers follow a five-step approach, including familiarization, coding, topic generation, theme evaluation, and theme definition and naming. The study also adhered to the five-step method. The detailed transcription of the recorded interviews for the study was the first step in the familiarization process. Extracts were reduced where necessary to exclude unnecessary discussions, repetition, and examples provided by the participants. The next step was the coding/labelling process. Coding is the process of marking key passages in transcripts and giving them labels that quickly summarize their meaning. The third step involved picking out themes. Typically, one theme can be created by combining multiple codes. Themes are typically more expansive than codes. The researcher then reviewed the themes to see if they were valuable and accurate summaries of the information. The themes were defined and given names in the last stage, which required giving each subject a short and simple name.

#### V. RESULTS AND DISCUSSION

What is the Customers' Nature of Behaviours Towards the Digital Transformation?

This study topic allowed the researcher to learn more about the types of behaviours that clients exhibit in response to the digital transition. Participants in this study explicitly acknowledged both the immediate and long-term benefits of the digital revolution. The analyses of the different experiences of customers have produced two main themes.

##### A. *Fitting to Lifestyle*

Digital banking is referred to as being a useful technology for customers to conduct their regular banking activities without going to the physical bank location. Customers' appropriate use of digital banking had a direct effect on the types of behaviours they exhibited. Importantly, depending on the advantages of digital transformation, the degree of

significance of adopting digital banking differs from case to case. The most apparent results connected to the nature of the customers are pertinent to lifestyle fitness. (Goodhue et al. 1995). The researcher's field experience confirmed this:

*I basically look at the ease of access to my banking account information. Also, digital banking is 100% fitness for my lifestyle (e.g. through online banking, I can make an appointment for the doctor and settle school fees for my children)... I feel digital banking is very important with my busy lifestyle....[FN1]*

*I am a heavy online user. I buy most of my stuff from online stores. Therefore, digital banking is very important to me to make online payments ... We do everything online; without online banking now, it is really difficult to live. [MN2]*

*I use an online banking facility to perform my share-market transactions. For me, online banking is something quick and easy for day-to-day tasks.[ME1]*

According to the participants, a busy lifestyle and a lack of family time are the major factors driving people to adopt digital banking. This aligns with the task-technology fit (TTF) in the technology acceptance theory (Venkatesh & Davis 2000). Hoehle and Huff, (2012) concluded that the task-technology fit model explains that technology has a positive influence on individual and technology adoption, depending partly on how much it fits with individual perception and support tasks. The definition of "fitness for lifestyle" or "relevance" is "an individual's perception of the extent to which a technology or a system is applicable to his or her day-to-day tasks" (Venkatesh et al. 2003).

It is evident that customers tend to use digital banking due to the level of time criticality. In the current financial environment, customers view some banking transactions as urgent and others as less time critical. All participants in the survey concurred that the adoption of digital banking was motivated by its complete suitability.

#### *B. Personal Image and Social Standards*

The study participants viewed digital banking as highly valued in society, as customers like to maintain a high level of prestige and autonomy. The researcher's field experience in follows provides evidence for it.

*Using digital banking is helping to maintain social standards. Therefore, I operate online banking for my easy use and to maintain my image ... As an accountant, I always try to maintain my good name. Therefore, digital banking is important to maintain my image. [FE1]*

*As a business entrepreneur, it is very important for my image. I believe digital banking is helping me to build up a good rapport with my clients and deliver a better service via online (e.g. on-time payment settlement of clients, same-day salary transfers of workers). [ME1]*

*I can see most of young people nowadays using digital banking products and services (e.g. credit cards, mobile banking apps, and online banking) to show-off and to maintain social standards. [MN1]*

Today, people use digital banking or online banking facilities to build a relationship with other individuals or communities at any place and any time (Ramírez-Correa et al. 2019). It was found that personal beliefs regarding the ability to use technology positively influence behavioural intention; this is theoretically inclined with the Theory of Reasoned Action (TRA) (Yousafzai 2012).

In the Sri Lankan context, where customers are likely to enjoy digital banking facilities rather than operating normal banking methods, is viewed as a prestige. Therefore, banks have introduced professional products and service schemes in online platforms like digital wallet accounts, affinity credit cards, platinum and signature credit cards, and priority banking service so customers can enjoy their banking while maintaining prestige. Also, those products enable customers to enjoy easy banking services (Lai & Zainal 2015).

#### *What are the Factors that Influence Banking Customers to Adopt Digital Transformation?*

This research question enabled the researcher to understand the main factors contributing to customers going for digital banking services. Participants described various factors associated with banking digital products and services. Common factors addressed by the participants are as follows.

#### *A. Maturity of Product or Service*

Quality of information and content are important measures of the information system success from the user perspective (DeLone & McLean 1992). User intention to adopt new technology like digital banking or internet banking depends on the technical design or content of the system. Further et al. (1989), identified that design features and content are directly related to perceived ease of use and perceived usefulness. In line with those studies, respondents of the present study have explained their experience as follows:

*Internet banking is very easy for me due to information availability, and it is less time*



*consuming. Also, in traditional banking, you are sometimes not getting the right information, and no one is responsible for that service (e.g. getting wrong advice over the phone) [FN3].*

In contrast, disagreeing with participant FN3, participant FN1 reported that;

*Digital banking uptakes are still low because all the required information is unavailable online, and sometimes it takes a lot of time to find the right information. Consequently, it may discourage people's use of digital banking due to time-delays and lack of clarity about the charges. [FN1].*

Prior research stressed that the most frequently used measures in the online environment are the content and quality of the information provided or available (Venkatesh & Davis 2000). In an online or e-banking environment, information is related to the report and traditionally used for accuracy, completeness, timeline, and relevancy (DeLone & McLean 1992).

#### *B. Easiness*

The availability and ease of digital banking are the primary draws for customers (Shariq 2006). Most prior research highlighted the ease of use of digital banking for customers. (Lallmahamood 2007). They also discussed how simple it is to use mobile devices to obtain banking information and conduct transactions. Au and Kauffman (2008) go over the advantages of mobile devices and digital technologies, such as simplicity of access.

*Having things stored online and being able to access them through your laptop, tab, mobile phone, or smartwatch makes it really easy. As an entrepreneur, I believe accessibility is very important. [ME1]*

*Compared to the conventional banking system, digital banking saves my time 100%. I can use my online banking applications and digital banking irrespective of geographical barriers or time barriers by using my smartwatch, laptop, or tablet. Another important thing is that digital banking is available 24/7 and 365 days of a year. On the other hand, even when I am abroad, it allows me to operate my banking account for any purpose. [FE2]*

In considering easiness, customers' perceptions include availability and convenience, mobility and discoverability.

#### *C. Availability and Convenience*

The analysis reveals that service availability and convenience are key to driving customers towards online

and digital platforms. Customers expect 24 hours of service and convenience value from digital banking. Service availability anywhere and anytime motivates customers to use digital banking services.

*Accessing my online bank account is very easy, and it is a simple click to make any transaction. Online banking services shouldn't entail a visit to a physical branch, and it is available for us 24 hours. Most importantly, I am a person who does reconcile my bank statements early in the morning or late at night; therefore, online banking services are open for me 24 hours [ME1].*

*Simply, if my mobile phone is with me, Bank is open to me for 24/7 and 365days [ME3].*

According to Seiders, Voss, Grewal, and Godfrey (2005), customers can save money and time by using mobile devices for transactions and internet banking. Significantly, every participant in this study stressed that their mobile device is their primary entry point for digital banking. Customers now demand internet chat and 24-hour support from their banks. Responses from participants are evident for the findings of Lai (2016), who addressed how new technology's perceived ease and usefulness affect customers' intentions to use it.

#### *D. Mobility and Discoverability*

Digital banking mobility refers to access to bank account details via the internet by using a digital device. Customers stated that two ways of mobility influenced or facilitated the adoption of digital banking in Sri Lanka. Following are the field experiences;

*I frequently travel to the UK for my office work and to meet my clients. While I am travelling, I can also operate my online banking account, and it's easy to monitor my day-to-day transactions online... I am a person who does all my banking operations using my mobile, and it allows me to perform whatever transaction while I am also travelling. Apart from that, even though I go to leisure destinations with my family, I do not need to find a physical branch to do any banking transactions. [FE2]*

*Now, wherever you go, the DB service is available 24 hours in Sri Lanka. With this modern technology, you can now access your banking details using a small watch, which becomes very easy to access anywhere. Therefore, I believe digital banking 100% suits to my busy schedule. [MN3]*

The results suggest that digital transformation offers unique products and services which the conventional banking channel does not offer. Au & Kauffman (2008),

further emphasize that mobile technologies as “anytime and anywhere computing” define the two common dimensions of mobility: independence of time and geographical location. More importantly, digital banking is accessible to customers in remote areas via online and offers the bank the ability to differentiate products and services with superior service.

#### *E. Usefulness*

Another important theme of digital banking is a sense of usefulness or results demonstrability (Venkatesh, Morris & Davis 2003). Usefulness refers to the use of digital transformation where the benefits are tangible. Responses explicitly explained such a positive feeling about digital products and services and how it motivated them to use digital banking.

*By starting to use digital banking, I feel digital banking is easy to use, and banking becomes easy. Also, benefits are tangible compared to traditional banking (e.g. no time wasting, no additional charges involved, hassle-free). [FE3]*

*With a busy lifestyle, digital banking is very convenient, and, importantly, that service can save cost and time. [FN1]*

Personal adopters can better understand the advantages of the use of new technology and its implications when results are tangible and demonstrable. The tangible advantages of technology are directly apparent, suggesting a positive relationship between usefulness and technology acceptance. In a banking environment, security, user confidence, and a sense of usefulness to achieve the desired result positively motivate customers to adopt the technology (Chau & Lai 2009).

#### *F. Security*

The analysis reveals that security is a key factor for every participant. They primarily look carefully at the security features offered, which gives them the confidence to use digital banking.

*Online banking app is very secure for me ... Nevertheless, people also lose money due to fraudulent transactions in online banking. [MN3]*

*Internet banking is risky, according to my knowledge, and that risk cannot be avoided but can be minimized. The bank has taken measures to prevent risk from unauthorized access and hackers, and platforms are well secured now. Therefore, risk elements are minimized by the bank (e.g. email confirmation for online transactions, SMS alert services, time to time password changing ability). [MN1]*

In complying with the respondents' statements, past studies have concluded the effects of risk perception on the

intention to use digital banking, and customers have identified the perceived risk dimensions (Littler & Melanthiou 2006). Lee (2009) discusses different kinds of risks associated with digital banking, like performance risk, social risk, financial risk, privacy risk, time risk and physical risk. Further, perceived risk or sense of loss directly influences the intention to use online or digital banking (Kesharwani 2012).

#### *G. Social Factors*

This theme explored participants' perspectives on the social factors and the impact on motivation towards digital transformation. Two sub-themes are identified under this main theme: corporate networking and maintaining group norms, personality or people's traits.

*In this modern world, everyone is moving to digital platforms. Therefore, I believe digital banking is important to build a relationship [ME2]*

*Digital banking has become a necessity in life. where we go, it is really important in our modern life. Especially not like in the old days, we cannot delay any payment due to various reasons (e.g. to perform a fund transfer in a weekend or on holiday, we cannot wait until the next working day). Therefore, to maintain a good relationship, digital banking is important. [FE2]*

As a result of social pressure to use digital banking technology, most customers are subject to the influence of others with consequences for their behaviour. Prior studies have noted that peers, family members and pressure groups might influence users to employ a certain technology (Scardovi 2017).

#### *H. Cost and Time Benefit*

Offering value-added services through various digital banking operations (such as credit cards, insurances, mortgages, current and savings accounts, utility payments, etc.) plays a crucial role in making users' lives simpler. This research found that banks and customers drive different digital banking values like time saving and cost saving.

*If we talk about traditional or normal banking, it involves a lot of extra charges apart from banking transactions (e.g. travelling, parking, call charges, and paper cost). The fee compared to digital banking is a bit extremely high for transactions. [FN2]*

*With the terrible traffic conditions on the roads and waiting time in the banking counters or queues, money is wasted. A lot of manual charges are involved in conventional banking methods such as over-the-counter withdrawal fees, fund transfer*

*fees, bank statements charges and other manual transaction charges. Compared to digital banking, it's more than ten times more expensive. [ME3]*

Generally, in the banking environment, customers choose convenient products and services that present their values and enjoyment. There are five different values included in customer value composition: functional value, conditional value, social value, emotional value, and epistemic value (Cengiz & Kirkbir 2007). In the online banking environment, Cengiz and Kirkbir (2007), found that the value of money has a positive effect on customer motivation to use technology. In line with the literature, all the participants of this research pointed out that digital transformation saves time and cost (e.g. travelling, manual transaction fees, paper costs and time wasting) while introducing convenience services.

### *I. Reliability*

Customer satisfaction is one of the most critical factors contributing to increased reliability. There is a significant relationship between information reliability and perceived security in the digital banking environment (Sweeney et al. 1997). Reliability is an important factor that motivates customers to use digital banking.

*The most important thing in digital banking is reliability, privacy, and data security. The information we are getting from online banking is more reliable and accurate. Therefore, I believe rather than referring to conventional banking; online banking provides more reliable information. [FE3]*

*Online banking is discoverable, flexible, and reliable. Importantly, online banking provides all the details before you perform a transaction and that information is important to validate the charges, cross-check the details and finally perform the transaction. [FE2]*

Reliability is a determining factor for repeatedly using online or Internet banking services (Xue, Hitt & Chen 2011; Ozkan, Bindusara & Hackney 2010). According to Yeh & Li (2009), technology reliability has a direct impact on customer satisfaction. In accordance with the Loureiro, Miranda & Breazeale (2014), participants in this research study further emphasized that customer satisfaction depends on reliable information and protecting their data privacy and security:

*Data privacy and security are key concerns for customers moving to online platforms such as internet banking or digital banking... I believe online provides reliable information rather than normal banking ... Ease of handling, system security, and reliability are the main factors we*

*are concerned about in digital banking ... and .... [FN3]*

In conclusion, reliability is a fact that enables digital transformation in the banking industry, as per the literature and the idea of the participants of the present study.

## V. CONCLUSION

This article provides in-depth information about how customers adopt or abandon digital transformation and what factors influence adoption to embrace digital transformation.

As highlighted in the literature, many researchers focused on quantifying digital transformation in different industries. Yet, little attention has been paid to customers' behaviours towards digital transformation, influencing banking customers to adopt digital transformation. Therefore, the findings of this study are anticipated to fill a further gap in the literature. Another major theoretical contribution lies in this research connecting customer perception and digital transformation while researching the banking industry.

Findings suggest that, in Sri Lanka, digital banking is beneficial technology for customers to do their day-to-day banking activities without visiting a physical bank branch. The pertinent usage of digital banking by customers directly impacted the customers' nature of behaviours. Furthermore, customers are more likely to use digital banking services instead of conventional banking methods. Participants also agreed that society places a high value on digital banking because users like to maintain prestige and autonomy.

With the help of the study question, the researchers identified the key factors influencing banking customers' adoption of digital transformation for routine banking activities. Participants discussed several elements related to digital banking goods and services. The participants listed several key themes: product or service maturity, usability, security, social factors, cost and time benefits, and dependability in the present environment. All of the participants agreed that using contemporary technology increased the worth of the products and offered convenient service.

Usefulness is defined as an individual's perception of using new technology to enhance their service experience (Davis et al. 1989). In applying this definition to the context of digital banking, usefulness refers to the degree to which customers experience that using online or digital Banking services as a medium enhances their performance or productivity. Speed, accessibility, detailed information, and availability have often been identified as the main benefits of online banking (Khalifa & Limayem 2003). According to the participants, findings were classified into

another major theme, usefulness. The participants in this research described how social factors could influence customer perception and attitudes toward using digital transformation. Due to social pressure to use digital banking technology, customers are subject to the influence of others, with consequences for their behaviour towards the usage of new digital products and services. Concerning the themes of social factors, it was found that variables influencing customers' decisions to adopt digital banking include the external impressions that people are subject to, and these refer to social influences and subjective norms. All participants accepted that the involvement of modern technology improved the value of products and provided convenient service. Answers were synthesized into a major theme called cost and time value. Answers grouped into another major theme, namely, reliability. Respondents cited different views based on their banking experiences with several banks. The researcher was able to obtain an in-depth understanding of digital banking adoption based on customers' experiences. In addition, it was found that engaging with digital banking was more convenient and less time-consuming.

The findings of this study have a number of important implications for future practices. Some practical implications are provided below in order to strengthen the bank's digital banking services. In particular, perceived ease of use and perceived usefulness are found to be important with regard to user acceptance of digital transformation in the banking sector. Therefore, the bank could consider launching campaigns to demonstrate the features of digital banking services, including the benefits and ease of use. It identifies key factors to consider when developing digital banking. Functional quality helps to determine digital transformation effectiveness. Therefore, the bank should consider accessibility features, instructiveness and user interface when designing new products or services.

A few limitations are linked with this study, some of which originate in constraints on time and money. Some of these, while limitations, provide paths for future research. The data collected for this study depended on the responses from one party (a bank customer) and can be viewed as somewhat subjective. Preferably, a second party would validate at least part of the information collected about the digital transformation. Data collected from the bank employees could have been used to confirm the business's information if more time and resources had been available. Moreover, this study focuses on customers' experience of digital transformation in the banking industry in Sri Lanka, and there are various conclusions from the study. Even though some researchers suppose their findings of a single country are generalisable to other countries, these findings cannot be generalised as a global phenomenon. Similarly, some of the aspects of this research are not necessarily

globally applicable, but they may be known in patriarchal societies.

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# Factors Affecting the Effective Usage of Medical Equipment in Sri Lankan Hospitals

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**Abstract** - In Sri Lanka's public hospitals, a large portion of the medical equipment is nonfunctional, unusable, or poorly maintained. It is of paramount importance to limit the nation's resource wastage amid the current economic crisis where people's access to healthcare is compromised. Developing nations like Sri Lanka face several difficulties in striking a balance between limited resources and better-quality healthcare services. Therefore, it is important to make optimal use of available resources in the healthcare system. There are many factors that have influenced the usage of the most recent technology in Sri Lankan Hospitals. In this study, 26 factors that influence the effective usage of medical equipment in Sri Lankan Hospitals were identified using the literature survey. A factor analysis was done to identify the main 4 factors with a higher influence on the effective usage of medical equipment. This study applied a cross-sectional study design, and 384 employees including nurses, biomedical engineers, medical officers, and doctors were selected by a convenient sampling method. Data were collected using structured self-administered questionnaires and analyzed using the SPSS (Statistical package software suite) at the level of significance of  $p < 0.05$ . Three reliability tests were performed namely Pearson correlation, Cronbach's alpha, and Cohen's kappa for the questions. This study shows that there is a positive influence of key factors financial resources, policy and regulatory framework, and training and education on effective usage of medical equipment. However, the main factor contributing to the effective usage of medical equipment is maintenance. A comprehensive analysis of the factors that influence the implementation of medical equipment management systems for Sri Lankan Hospitals is presented in this research.

**Keywords** - Medical Equipment, Patient care, Inefficient usage, Health care system.

## I. INTRODUCTION

In Sri Lanka's hospitals, a major portion of the medical equipment is nonfunctional, unusable, or poorly maintained. As a result, the nation's resources are wasted, and access to quality patient care is compromised. The high rate of equipment failures has resulted in an increase in equipment downtime in Sri Lanka's public sector hospitals. It is shown that medical equipment maintenance is considered a financially advantageous strategy to boost equipment availability in health facilities in situations with

limited resources (Hillebrecht *et al.*, 2022). To get the most out of the available biomedical equipment, operating and maintaining it economically is crucial.

On the other hand, improper handling, and maintenance of them could result in inaccurate results and endanger the user's and patient's safety (Koggalage and De Alwis, 2019). Not only that, but it is also evident that the world is evolving amidst this economic crisis, hence it is the role of researchers to identify the approaches to overcome the crisis and assess the gaps and barriers hindering the process.

There are many factors that influence the effective usage of medical equipment in hospitals, such as maintenance costs (Salim *et al.*, 2019), lack of maintenance (Sritart *et al.*, 2023), and lack of documentation and records (Zamzam *et al.*, 2021). Lack of responsible authority to ensure the accuracy and reliability of medical equipment (Salim, Mazlan, and Salim, 2019), limited availability of resources and support for health professionals (Zamzam *et al.*, 2021), and continued use of obsolete components (Acevedo, Fuentes and Enderle, 2005) (Dasanayaka and Sardana, 2011), also have a main influence on decreasing the lifetime of medical equipment. Budget constraints or resource limitations, government regulations, and lack of proper technical infrastructure (Dasanayaka, 2001) have limited the usage of high-tech medical equipment in Sri Lankan hospitals. A few other reasons for this situation are the purchase of complex equipment which is underutilization because of a lack of knowledge and skills (Dasanayaka and Sardana, 2011) and improper use that shortens the lifetime of the equipment. Not only that, the lack of standards and policies has resulted in many management and governance issues such as corruptive underhand deals (Dasanayaka, 2001) relating to healthcare equipment. It has been recognized that Sri Lankan healthcare professionals currently employed in hospitals demonstrate a dearth of applied skills and competencies in handling advanced biomedical instruments.

There is currently no evidence that hospital systems for managing medical equipment have been adopted in Sri Lanka. The main barriers to implementing such efforts have been a lack of infrastructure, external pressures, internal distractions, and a lack of human commitment

because Sri Lanka's governance framework is fragmented (Jayawardena, 2017).

As a result, any implementation attempt is fragmented and does not follow common standards. Therefore, this research intends to identify the important success variables affecting the effective usage of medical equipment in Sri Lankan hospitals as a first step toward the development of a framework for medical equipment management systems for Sri Lankan hospitals. The deficiencies in the Sri Lankan healthcare sector may be determined using this research, which will help to implement national medical equipment management systems.

The objective of this research is to recognize the key factors affecting the effective usage of medical equipment in Sri Lankan hospitals. Subsequently, assess the challenges and barriers that could hinder the effective usage of medical equipment in Sri Lankan hospitals. Finally, offers recommendations for how to effectively use medical equipment in Sri Lanka.

## II. METHODOLOGY

A cohesive and logical analysis of the elements influencing the effectiveness of medical equipment utilized in Sri Lankan hospitals is essentially elaborated in the research design of this study. The population is determined by human resource profile 2016, Ministry of Health. With the inputs of 54575 as the population size, a 95% confidence level, and 5 margins of error, the Krecjie and Morgan formula (1970) is used to determine the sample size. It was calculated as 382 and there were 384 responses to the questionnaire. The sample corresponds to the employees who are currently working with medical equipment in the health industry. The sampling method used for this study is convenience sampling since it enables them to evaluate the samples conveniently and produces more samples. The Colombo East Base Hospital served as the site of most of the data collection.

### A. Literature Survey

The literature survey was conducted to identify the factors affecting the effective usage of medical equipment.

### B. Designing Questionnaire

The questionnaire was designed based on the factors identified in the literature survey.

### C. Data Collection

The data were collected by distributing the questionnaire to the target sample population. The primary audience for this study will be the hospital employees, so a Google form with a survey-based online questionnaire will be created and delivered to them as the first step in gathering data.

### D. Data Entry and Cleaning

The data were entered into a spreadsheet using 5 – point Likert scale and removed any errors or inconsistencies.

### E. Descriptive Statistic

Descriptive statistics such as mean and standard deviation were calculated per question.

### F. Reliability Analysis

The Internal consistency of the questions were checked by applying the Pearson correlation, Cronbach's alpha, and Cohen's kappa.

The following hypothesis was constructed after factor analysis.

H1: The accessibility of sufficient financial resources has a positive influence on the effective usage of medical equipment in Sri Lankan government hospitals.

H2: Proper maintenance positively influences the effective usage of medical equipment in Sri Lankan government hospitals.

H3: Personnel training and education have a positive impact on the effective usage of medical equipment in Sri Lankan government hospitals.

H4: The supportive policy and regulatory framework has a positive influence on the effective usage of medical equipment in Sri Lankan government hospitals.

## III. RESULTS AND DISCUSSION

Descriptive statistics **Error! Reference source not found.** including the mean and standard deviation were computed to determine the variability, distribution, and central tendency of the variables as well as outliers. The mean of the data was greater than 4, implying the central tendency of data is at 4 (Agree) on the 5-point Likert scale.

Table 01: Descriptive Statistics of the factors

Descriptive Statistics			
Variable	Mean	Std. Deviation	N
IV1 - Policies and Regulatory Compliance	4.260	.909	384
IV2 - Training and education	4.523	.728	384
IV3 - Maintenance	4.143	.934	384
IV4 - Financial Resources	4.530	.621	384
DV - Effective Usage of Medical Equipment	4.313	.458	384

Cronbach's alpha coefficient for the scale's 25 variables is 0.713 as shown in **Error! Reference source not found.**, which shows that the scale is reliable and suitable for factor analysis.

Table 02: Reliability test for Full Dataset using Cronbach's Alpha.

Reliability Statistics	
Cronbach's Alpha	N of Items
.713	26

Among the collection of observed variables in the questionnaire, factor analysis was used to isolate the critical elements that influence the efficient use of medical equipment in Sri Lankan hospitals. Using the factor analysis method, variables with similar statistics were integrated into a single component. Therefore, key factors that influence the efficient use of medical equipment can be isolated. These key factors are essential in determining major aspects that should be prioritized in the implementation of medical equipment management systems which could ultimately increase Sri Lanka Hospital's productivity and efficiency and patient care.

Cohen's kappa coefficient 25 variables are 0.71 as shown in 3, which shows that the inter-rater reliability is appropriate.

Table 03: Reliability test for Dataset using Cohen's kappa

Symmetric Measures					
		Value	Asymptotic Standard Error <sup>a</sup>	Approximate T <sup>b</sup>	Approximate Significance
Measure of Agreement	Kappa	.71	.123	3.480	.000
N of Valid Cases		25			
a. Not assuming the null hypothesis.					
b. Using the asymptotic standard error assuming the null hypothesis.					

The results of Table 4 explain how well the regression model fits the data. The R-value of .926 depicts that there is a positive correlation between independent variables and the Effective Usage of Medical Equipment. In addition, this model explains the 85.7 percent variation in the Effective Usage of Medical Equipment in Sri Lankan government hospitals.

Table 04: Regression analysis summary for independent and dependent variables.

Model Summary <sup>b</sup>				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.926 <sup>a</sup>	.858	.857	.173
a. Predictors: (Constant), IV4 - Financial Resources, IV2 - Training and education, IV1 - Policies and Regulatory compliance, IV3 - Maintenance				
b. Dependent Variable: DV - Effective Usage of Medical Equipment				

Table 05: ANOVA results

ANOVA <sup>a</sup>					
Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	68.859	4	17.215	572.98	.000 <sup>b</sup>
Residual	11.387	379	.030		
Total	80.246	383			
a. Dependent Variable: DV - Effective Usage of Medical Equipment					
b. Predictors: (Constant), IV4 - Financial Resources, IV2 - Training and education, IV1 - Policies and Regulatory compliance, IV3 - Maintenance					

Table 05 examines the variance between the variables. The value of F is statistically significant at a level of 5%, therefore there is a linear relationship between variables. The p-value for the regression is 0.000, which suggests that the model is significant (p < 0.05). Therefore, the chosen model fits the data well.

Table 06: Regression coefficients were obtained for the independent variables

Coefficients <sup>a</sup>					
Model	Unstand. Coefficients		Stand. Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	.578	.110		5.261	.000
IV1 - Policies and Regulatory Compliance	.212	.010	.421	21.682	.000
IV2 - Training and education	.035	.012	.055	2.859	.004
IV3 - Maintenance	.421	.010	.859	43.536	.000
IV4 - Financial Resources	.206	.015	.279	14.162	.000

Therefore, the linear regression equation for this model is as follows.

Effective use of medical equipment in Sri Lankan government hospitals

=

$$0.578 + 0.212 * \text{Policies and Regulatory compliance} + 0.035 * \text{Training and education} + 0.421 * \text{Maintenance} + 0.206 * \text{Financial Resources}$$

The beta values for Unstandardized Coefficients demonstrate the factor Maintenance have greater weightage in the Effective use of medical equipment in Sri Lankan government hospitals, whereas the significance for the independent variables Policies and Regulatory Compliance, Training and Education, Maintenance, and Financial Resources are 0.000, 0.000, 0.004, and 0.000 respectively as shown in Error! Reference source not found examines the variance between the variables. The value of F is statistically significant at a level of 5%, therefore there is a linear relationship between variables. The p-value for the regression is 0.000, which suggests that the model is significant ( $p < 0.05$ ). Therefore, the chosen model fits the data well. Therefore, the null hypothesis corresponding to the independent variables H10, H20, H30, and H40 can be rejected because all the values of p satisfy  $p < 0.05$ .

#### IV. CONCLUSION

The main aim of this empirical study was to determine the key factors that influence how well medical equipment is

used in Sri Lankan government hospitals. The main research objectives can be considered as having been successfully achieved based on the results. The data was acquired from a structured questionnaire comprising 26 variables which were eventually divided into 5 primary elements using factor analysis. The demographic information was initially examined using Microsoft Excel. Some of the attributes of the sample population were determined from the findings, and it was found that nurses made up the majority (52%) of those who responded because are highly involved with the operations of medical equipment. The five key factors identified in this research are Policies and Regulatory Compliance, Training and Education, Maintenance, and Financial Resources.

The results demonstrate that there is a positive influence from Policies and Regulatory Compliance, Training and Education, Maintenance, and Financial Resources to the effective usage of medical equipment in Sri Lankan government hospitals. Furthermore, the factor maintenance has a greater influence on the effective use of medical equipment in Sri Lankan government hospitals than the other three factors. This study provided a systematic analysis of the variables that affect infers the implementation of the medical equipment management system for Sri Lankan hospitals.

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#### AUTHOR BIOGRAPHY



I, Sanuththara Ranasinghe, am dedicated and passionate professional in the field of biomedical engineering. With a strong academic foundation, I hold a Bachelor of Science (BSc) degree in Biomedical Engineering and is currently pursuing Master of Science (MSc) in Biomedical Engineering. My internship provided me with invaluable insights into the intricacies of healthcare equipment utilization and the challenges faced by hospitals in Sri

Lanka. The main aim of my work is to contribute to the enhancement of healthcare services and the optimization of medical equipment usage, ultimately improving patient care in his home country and beyond.

# The Impact of Logistics Function on the Performance of an Organization

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**Abstract** - As an island, which seeks to thrive from area of logistics, the development of the logistics industry is significant since it acts as a vigorous supportive arm for the economy. Furthermore, the logistics functions in the industry are a paramount factor that assists to maintain a stable performances within the organizations and long-term reduce the price of the end product with efficient logistics practices. With the challenges faced by the supply chains in the whole world there has been ups and downs in the logistics industry, researchers have identified that there is contemporary requirement of assessing dimensions of logistics functions in order to find the impact on organizational performances. Moreover, the researcher has identified four functions of logistics which effect the organizational performance as warehousing, inventory management, transportation and order processing. In order to achieve the objectives of this study, the researcher have conducted multiple regression analysis by collecting the data from employees at MAS holdings Borupana. Finally, thematic analysis was done on the collected data to prove or double assure the responses received from the managers. As research findings, researchers exposed a strong positive correlation between the dimensions as warehousing as the most significant dimension of organizational performance at MAS holdings borupana. Furthermore, researchers can look in to the all companies within Sri Lanka and find the impact of logistics functions on overall performances of the company. practitioners should more concern about the revealed factors of this study to find out the impact of logistics functions on organizational performance.

**Keywords** - Warehousing, Inventory Management, and Organizational Performance

## I. INTRODUCTION

Despite its evident significance, logistics has not always gotten enough consideration. Historically, organisations focused only on the production of goods and paid little thought to the accompanying transportation of materials. Managers acknowledged that transport and storage were necessary, but considered them as unimportant technical difficulties; they were merely seen as unavoidable business expenses (waters,2003). Logistics is a set of operations that assures the availability of the appropriate items in the appropriate amount to the appropriate clients at the

appropriate time. Frequently, logistics is undervalued or underappreciated. In many organisations, logistics is considered as a cost centre, not a strategic asset (Mentzer et al., 2004). Such an argument is reinforced by Fugate et al. (2008) study examining the importance of logistics inside businesses. According to one of the authors' respondents, "many conventional logistics operations are regarded non-value added and tactical" in his organisation (p. 17)(Sink et al., 1996). This mentality may have detrimental repercussions on the logistics department and the business as a whole. Thankfully, there are businesses who appreciate the importance of logistics and consider it as a source of competitive advantage (Fawcett et al., 1993). To guarantee that logistics is fully exploited and generates the maximum value for the organisation, the function and its capabilities must be understood and utilised (Williams et al., 2009). In other words, logistics must be "sold" or brought to the forefront of the business (Zacharia and Mentzer, 2004). The objective should be to make people in the company aware of the value generated by logistics (Zacharia and Mentzer, 2007). If logistics is deemed significant, workers from other company divisions will have a higher understanding and regard for logistics' capacity to aid them in their daily work (Ralston et al., 2013)(Sohail et al., 2006). The majority of companies do not comprehend how the logistics function can impact their overall performance. Typically, companies focus on their marketing, finance, human resource, and other functions, but pay less attention to their logistics function, despite the fact that logistics can contribute significantly to the company's performance. Through this study, we are assisting in the understanding of how organisations that pay the utmost attention to logistics function and enhance the performance of the logistics of the company have achieved outstanding outcomes across the board (Jagersma, 2011).

## II. METHODOLOGY AND EXPERIMENTAL DESIGN

This research was done on the Borupana branch of MAS Holdings. The purpose of the study was to assess the impact of the logistics function on the business. MAS holding was chosen for this research because it focuses on fashion and lifestyle, is one of Asia's largest manufacturers of intimate apparel, sportswear, performance wear, and swimwear, provides IT solutions to the global apparel and footwear industry, and owns Sri Lanka's first international

lingerie brand, Amanté. The MAS holding textile manufacturing company obtains cotton as its primary raw material from various regions of the globe and sells its product mix to both domestic and international markets. In this way, logistics plays a significant role in the daily operations and overall performance of the organisation. Logistics management is a broad concept. Companies undervalue organizational logistics operations, according to the problem statement in chapter 1, but this has an indirect impact on the organization's performance as a whole. It establishes the market performance growth of the complete firm. The conceptual framework has four dimensions: order processing, inventory management, transportation, and warehousing to meet the study's objectives. The theoretical underpinning of this study's conceptual framework is the conceptual model put out by Narunart & Panjakajornsak (2019) in the literature review. Yang & Peterson, Yang & Parasuraman, Chen & Dubinsky, Parasuraman & Grewal, and 2003 (2004).

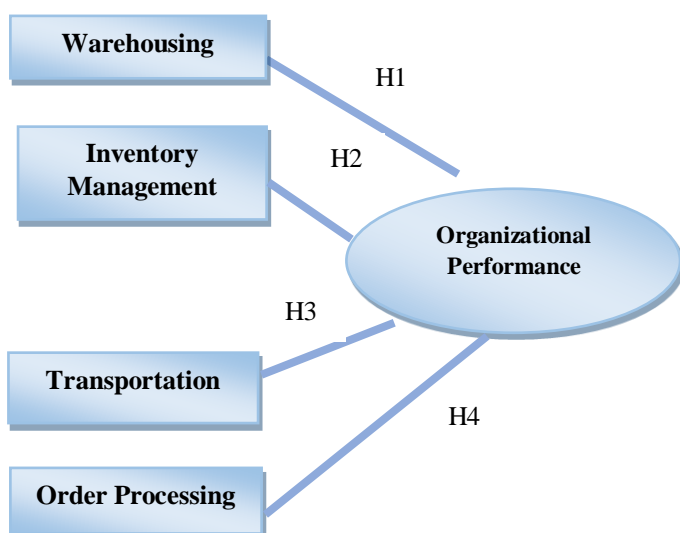


Figure 1: Conceptual Framework

Source: Developed by the Authors (2022) based on Narunart and Panjakajornsak (2019)

In order to confirm the validity and dependability of the 50 surveys, the researchers performed survey validation interviews with three industry experts. Using their feedback, they restructured the questionnaire using more complete and dependable items. Data was gathered, entered into Microsoft Excel, and exported to IBM SPSS (Version 22). The sample characteristics were explained using MS Excel-based bar charts, column charts, and pie charts. The data were analysed using statistical analysis methods including mean and frequencies using MS Excel and IBM SPSS (Version 22). Cronbach's Alpha is used to do a reliability test for the questionnaire survey. This approach was used by Chen and Dubinsky (2003) as well to guarantee the accuracy of the data collection. KMO and Bartlett's Test were used to assess the suitability of the

sample. In light of this, the quantitative technique was used in this study's data analysis. The link between each variable and organizational performance has been determined using linear regression analysis to meet the research objectives. The most important factors influencing organizational performance have been found through study using linear regression. The main program for carrying out the data analysis was IBM Statistical Package for the Social Sciences (SPSS) version 22. An interview was conducted as part of the qualitative data collecting process for the next particular goal, which was accomplished utilizing a thematic approach. Three business professionals gathered the qualitative information to ascertain their opinions and perceptions on the influence of logistics operations on an organization's performance. In order to meet the goals of their study, which was to assess organizational performances, Khadka & Maharjan (2017) used the same quantitative data collection method.

### III. RESULTS

Prior to starting data analysis, it is required to determine the characteristics of the sample that will be utilized for data collecting and analysis. The logistics division of MAS Holdings Borupana, where the personnel are skilled in warehousing, inventory management, order processing, and transportation, was the setting for the stratified random sampling approach, which was used to select a sample of 50 employees. Employees at all levels of the organization, from strategic to operational, collected the data. Three interviews were also conducted: two with top-level managers and one with middle-level managers. 56% of the chosen personnel are operationally involved, which is the in high percentage of the workforce. Secondly, only 4% of employees work at the strategic level, whereas 40% of people are involved in management.

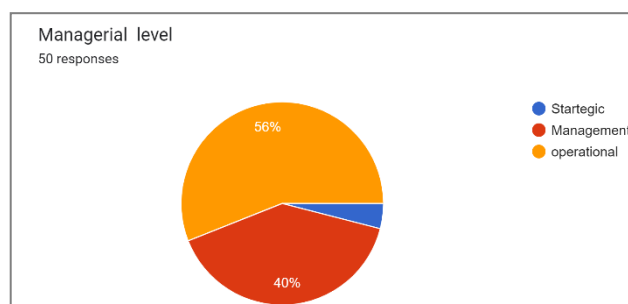


Figure 2: Managerial Levels of Employee  
Source: Survey Data (2022)

#### A. Section/ Department/ Unit

The respondents to the survey, specializes in jobs as in the sample operate according to logistics functions as warehousing, inventory management, transportation, and order processing in the company.

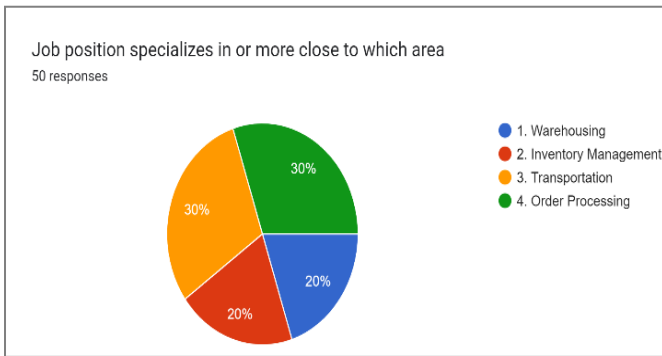


Figure 3: Specialization of Job Position  
Source: Survey Data (2022)

Figure 3 displays the job specializations of warehousing, inventory management, transportation, and order processing. Transport and order processing are shown to make up the majority as 30% for each, followed by warehousing and inventory management at 20% each

#### B. Descriptive Statistics

In the Table 1 the descriptive statistics of the 5 independent and dependent variables are shown in the minimum column the responses to each question related to each variable and the responses in minimum range is 2 for warehousing and inventory management whereas for the other 3 it starts with 3 which is neutral in the Likert scale and the maximum answers has been strongly agree for all questions of the variables and mean and standard deviation is as shown, (Ralston et al., 2013)

#### C. Normal P-P Plot of Dependent Variable

To check for linearity figure 4, the typical P-P plot from the obtained data set should be shown. If the dependent variable (output variable) has a smooth normal

Descriptive Statistics					
	N	Min	Max	Mean	Std. Deviation
<b>WH</b>	50	2	5	3.94	0.544
<b>IM</b>	50	2	5	3.97	0.579
<b>TM</b>	50	3	5	4.01	0.536
<b>OP</b>	50	3	5	4.05	0.465
<b>Per</b>	50	3	5	4.11	0.615

distribution, the plot will be normally distributed.

Table 1: Standard Residual Statistics

Source: Survey Data (2022)

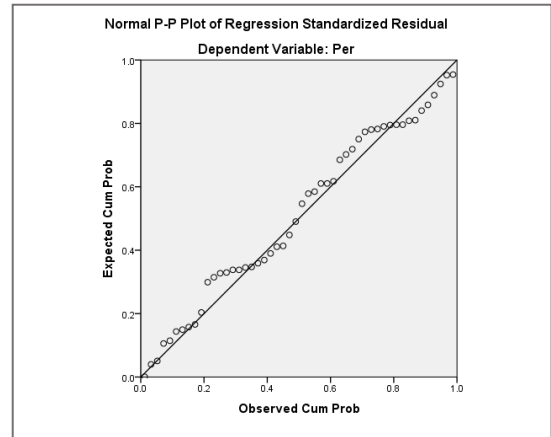


Figure 4: Normal P-P Plot of Regression of Dependent Variable  
Source: Survey Data (2022)

Figure 4 shows that the data is linearly related to organizational effectiveness throughout. The criterion has been met because the data is close to the line. The dependent variable, organizational performance, has a smooth normal distribution. From this figure we can get an idea that the questions related to each other that is the dependent questions and independent questions has a good relationship as the dots are aligned with the graph, (Paula et al., 2020).

#### D. Multiple Regression Analysis

To meet the research objective impact of Warehousing, Transportation, Inventory management and Order processing logistics functions effects organizational performance. The researchers ran a multiple regression analysis. In order to determine the most important factor that effects the organization performances, IBM SPSS (version 22) was used. The influence or effect between the dependent variable (outcome variable) and independent variable can be determined by the researchers by performing a multiple regression analysis (s). It assists in identifying which dimensions are most crucial, which ones might be neglected, and how those dimensions relate to one another. The unstandardized coefficients reflect the degree of correlation between the dependent variable and that particular independent variable while all other independent variables are held constant. The interpretation can be made based on whether the B value is positive or negative. To acquire a substantial unique contribution for forecasting the output variable, the significant value must also be smaller than 0.05. (Dependent variable).



2) *Relationship between organizational performances and inventory management*

The relationship between organizational performance and inventory management is above 0.05 therefore it is unsatisfactory and as inventory management doesn't have a significant value, the independent variable doesn't have an impact on the organizational performance.

Table 2: Output of the Multi-Regression Analysis

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std.Error	Beta		
1(Constant)	-0.117	0.864		-0.135	0.893
WH	0.431	0.156	0.381	2.768	0.008
IM	0.344	0.227	0.196	1.516	0.137
TM	0.433	0.157	0.377	2.75	0.009
OP	-0.157	0.227	-0.091	-0.693	0.492

Source: Survey Data (2022)

The coefficients for warehousing and transportation that were statistically significant are shown in Table 2 since their significance levels are less than 0.05 (P<0.05). Further analysis revealed that order processing and inventory management were not statistically significant because their P values were higher than 0.05 (P > 0.05). As a result, it can be said that order processing and inventory management (dependent variables) do not significantly contribute to the prediction of organizational performance (output variable). With statistical significance, the study determined that Warehousing and Transportation favourably influence or affect organizational performances (output variable) by taking into account the aforementioned table 2. using multi regression analysis determine the logistics functions' most significant dimension influence on organizational performance. Because warehousing has the highest unstandardized coefficients B value in table 2, the researchers have determined that it is the most important dimension. While the specific goal of this study, the impact of logistical activities such as warehousing, inventory management, transportation, and order processing on organizational performances, was accomplished through the use of multiple regression analysis.

1) *Relationship between organizational performances and warehousing*

The relationship between organizational performance and warehousing is below 0.05, therefore it is satisfactory, and warehousing is a significant independent variable that has a positive impact on the organizational performance.

3) *Relationship between organizational performances and transportation*

The relationship between organizational performance and transportation is below 0.05 therefore it is satisfactory, and warehousing is a significant independent variable that has a positive impact on the organizational performance.

4) *Relationship between organizational performances and order processing*

The regression between organizational performance and inventory management is above 0.05 therefore it is unsatisfactory and as order processing doesn't have a significant value, the independent variable doesn't have an impact on the organizational performance.

IV. DISCUSSION

According to the impact of logistical functions on organizational performance, the author of this study found four elements, A corporation must go beyond basic logistics operations to highly skilled logistics functioning since supply chain management and logistics have grown to be a competitive sector.

In light of this, the current study focuses on the variables that affect organizational performance and examines the relationships between logistics operations and organizational performance. Chen & Dubinsky (2003), Narunart & Panjakajornsak (2019), and Yang & Peterson (2004). warehousing, inventory management, transportation, and order processing were among its four dimensions. Results were interpreted in accordance with the research objective and each of those objectives' results was addressed. The researchers did multiple regression analysis to examine the four dimensions that affect organizational performances. Four factors and organizational performance are correlated by multi-regression analysis. The exact alignment of two dimensions with their corresponding relative dimensions has been proven. In contrast, the two dimensions' alignment with the respective variables was not complete. The researchers' goal for the study has been accomplished using multiple regression analysis. The researchers used

multi regression analysis to determine that warehousing is the most important factor affecting organizational performance in the MAS holdings.

#### *4.1 Interpretation of Research Findings of warehousing and how it effects the organizational performances*

Improvements in warehouse functionality have increased along with the emergence of businesses like Industry 4.0. (Atieh et al., 2016).

Each of the independent variables listed above has undergone a linear regression analysis. The independent computation of each variable results in a linear connection with organizational performances. Each variable needs to be smaller than 0.05 in order for there to be a positive association. The value of the warehousing variable is 0.008, as displayed in Table 2 The previous sentence validates the value. For distribution centre management to remain effective, warehouse activities should be more adaptable with their resources (Autry et al., 2005) and procedures. The results demonstrate that warehousing has a positive impact on organizational performance.

As proven by the quantitative analysis that there is an impact by the warehousing function on the performance of the MAS holding company. This can be verified with the answers given by the managers in their interviews, as per the statistics warehousing function has the most impact on the organizational performance. This is true as they are outsourcing their warehousing and when outsourcing the best can done as specialist in that field is undertaking the warehousing part and the MAS holdings can focus on the core business activities and then in return the organizational performances increase.

#### *4.2 Interpretation of Research Findings of Inventory management and how it effects the organizational performances*

A linear regression analysis has been performed on each of the independent variables indicated above. Each variable in table 2 is computed independently to produce a linear association with organizational performances. For there to be a positive relationship, each variable must be less than 0.05. The inventory management variable's value, as shown in Table 2 is 0.137. The value is not validated by the previous phrase. The findings show that inventory management has a negative impact on organizational performance.

Inventory management has a negative impact on organizational performance, with the slightly unfavourable responses from the inventory department and the unequal distribution of responders from each variable.

#### *4.3 Interpretation of Research Findings of transportation and how it effects the organizational performances*

The above all independent variables are analysed under linear regression analysis method. According to that in table 2, each variable is calculated separately, to get the linear relationship with the organizational performances. To certify a positive relationship each variable should be in less than 0.05. in table 4.9, for transportation variable the value interprets as 0.009. the value is confirmed from the above statement. Therefore, the results define transportation effect in a positive impact to organizational performances.

Finally, all above information that grant a positive relationship for organizational performances by transportation variable as information exchange should improve logistics performance because it's necessary for transportation (Kim and Lee, 2010; Wong et al., 2015; Raweevan and Ferrell, 2018; Viet et al.,2018).

#### *4.4 Interpretation of Research Findings of order processing and how it effects the organizational performances*

All of the independent variables listed above have been analyzed using linear regression. To obtain a linear relationship with organizational performances, each variable in table 2 is calculated independently. Each variable should be in less than 0.05 to confirm a positive link. Table 2 shows that the value for the order processing variable is 0.492 as indicated. From the sentence above, the value is not validated. Thus, the results define the order processing does not have an effect on organizational performance.

Whether the chart flows in linear, according to received values confirm that order processing has not a direct impact on organizational performances as the values aren't fulfil mentioned requirements. Finally, all above information that grant a negligible relationship for organizational performances by order processing variable.

## V. CONCLUSION

According to above data analysis and charts, the warehouse and transportation aspects have a positive impact on the organizational performances to continue operating, as can be seen from the aforementioned data. When addressed questions from the transportation and warehousing industries, the staff responded more effectively. And the other two hypothesis which is inventory management and order processing, the outcomes are frequently overwhelmingly unfavourable from the viewpoint of workers. Such a conclusion can be reached because every inquiry made is insightful responses. Although the transportation and order processing sectors employ the majority of the workforce, the order processing sector received the fewest positive comments. Even though the warehousing receives little assistance, the positive answers there are greatly valued. Thus, now can definitely say that the functions of transportation and warehousing have a direct positive impact on a company's ability to

survive. Therefore, we can come to a conclusion that the warehousing and transportation has an impact on the organizational performances and inventory management and order processing doesn't have an impact on the organizational performances on the MAS holdings Borupona, and to dig deep in to this aspect more the sample amount can be increased and the equal number of individuals can be taken from each 4 independent variables to get an fair result.

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# Impact of Bank Finance, Government Support and Psychological Factor on the Start-Up Decision Making in Sri Lanka: Special Reference to Homagama Division

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**Abstract** - This research aims to test the impact of bank finance and government support on initiating entrepreneurial ventures and start-ups. This study used a quantitative approach. Data were collected through a survey method using a questionnaire. The study's respondents were 203 entrepreneurs and businessmen in Homagama Divisional Secretariat Division in Colombo district, Western Province, Sri Lanka. Exploratory factor analysis and confirmatory factor analysis were performed to identify the impact of bank finance and government support on the initiation of entrepreneurial ventures and start-ups and test the convergent and discriminant validity. Cronbach's  $\alpha$  analysis was carried out to test the reliability of the dimensions. In addition, criterion-based validity and the stability of the impact of bank finance and government support on the initiation of entrepreneurial ventures and start-ups were also tested. All the tests were conducted using the SPSS software with the extension PROCESS 4.0 to test the entrepreneur's moderator;  $t_e$  age. The study has been proven to have good validity, reliability, and stability for measuring the impact of bank finance and government support on initiating entrepreneurial ventures and start-ups in the Homagama Divisional Secretariat Division in Colombo District, Western Province, Sri Lanka. This research was carried out in a single developing country, Sri Lanka. Hence, the stability of the model needs to be tested in different cultures. Government and the Bank Financing authorities can use this study to monitor, measure, and improve the service quality of their services towards start-up ventures and entrepreneurial firms. Hence it is proved that even though people have enough motivation and locus of control, support from the external authorised parties is the factor that determines successful start-up decision-making.

**Keywords** - Bank Finance, Government Support, Psychological Factor, Start-up Firm

## I. INTRODUCTION

A startup business can be defined as a business at its initial stage. There are so many types of businesses in the world. Those businesses are on small, medium, and large scales.

Entrepreneurial ventures are also belonging to that. Entrepreneurial startups play a significant role in the economy. Psychological factors influence straight to start-ups and entrepreneurship. Stronger people will have a high-level trend to succeed in entrepreneurship (Kibler et al., 2014). Need for accomplishment, self-efficacy, locus of control, the patience of uncertainty, innovativeness, risk take-on tendency, independence and autonomy and optimism are the main elements used to forecast the achievements of a start-up (Chatterjee and Das, 2015). Apart from that, risk-taking ability and self-motivation are some of the best skills of an entrepreneur (Chatterjee et al., 2019). According to (Sinclair, 2021), an entrepreneur always generates new business by taking risks and entertaining many rewards. The sustainable growth of startups and entrepreneurial ventures is very much important for a country's economic development in the global context. Compared to some countries in South Asia, like Vietnam and Thailand, Sri Lanka has less enrollment in entrepreneurship activities (Silva, 2019). Therefore, it needed to pay more attention to encouraging entrepreneurship to have more economic development. For that purpose, focusing on the challenges entrepreneurial ventures face in their initiating processes and further proceedings is essential. The capital shortage is one of the main challenges entrepreneurs face in Sri Lanka (Ranasinghe, 2019). Sri Lanka faces challenges in providing adequate finance for startups and entrepreneurial ventures due to unaffordable features, high-interest rates, mortgage requirements, and security concerns. Documentation requirements and lengthy loan processes discourage startups from seeking finance through banks and other financial institutions. This has led to some finding alternative solutions or abandoning innovative ideas. To address this issue, a national fund and affordable loan schemes are needed through banks and other financial institutions to support startups and entrepreneurial ventures.

Government support is crucial for the success of start-ups and entrepreneurial ventures in Sri Lanka. Assistance in tax relief, marketing facilities, and proper supervisory arrangements can enhance performance. Addressing the

shortcoming in start-ups can help overcome issues and enhance entrepreneurship, ultimately contributing to economic development.

## II. JUSTIFICATION OF THE STUDY

There are different financial sources available for start-ups in Sri Lanka. However, more research needs to be done to measure these funding sources' effectiveness. Thereby, an empirical gap exists. This research is done to find how these affect the decision-making process and the start-up firm's decision-making. As pointed out by (Nijhof, Andre HJ Jeurissen, 2017), empirical evidence has to discover the difference in effectiveness through different financing resources and their availability for entrepreneurs of several attributes. There is research on marketing orientation and its impact on start-up decision-making. As stated by (Kuruppu, 2015), (and Shoham et al., 2005), it should be fascinating to discover the relations between other directions like financial orientation and the start-up decision.

In the international context, there is only a limited amount of literature regarding psychological factors and their effect on start-up intention, leading to a considerable knowledge gap. This study remained performed during a pandemic, and data gathering was done mainly by a self-administered online questionnaire and telephone survey; therefore, action is significant in this research compared to previous research.

## III. PROBLEM OF THE STUDY

The research explores the access to capital investment for entrepreneurs in Sri Lanka, highlighting the availability of bank loans and government funds as the primary resources. It questions the necessity of bank loans when applicants already possess sufficient property and wealth. The study also emphasizes the challenges in obtaining loan approvals and the delays in receiving the required capital. Additionally, the research underscores the need for further investigation into the relationship between entrepreneurial orientations, age, and the success of IEBVs and the influence of psychological factors on start-up plans.

Banks follow a condition in which they are supposed to grant loans concerning the Debt-Income ratio and the available movable and immovable property. However, it is questionable that the reason for applying for bank loans is that applicants have enough property and wealth.

Mrs A.M. Amarasinghe expresses her dissatisfaction with bank loans for start-ups in Sri Lanka, mentioning the challenges faced in obtaining loan approvals and delays in receiving the required amount of money. The study conducted by Nijhof and Jeurissen (2017), based on US statistics but applicable to other countries, emphasises that access to public financial organisations is a common issue for entrepreneurs and start-ups regardless of the country.

The research highlights the need to investigate further the relationship between entrepreneurial orientations, age, and success in International Entrepreneurial Business Ventures (IEBVs). It emphasises the importance of exploring risk-taking, proactiveness, and innovativeness in entrepreneurial preferences, entrepreneur age, and choosing to enter less productive firms using a representative sample (Kropp et al., 2008).

Psychological factors significantly impact starting a new business venture. Fear of failure has an inverse relationship with entrepreneurial venture entry, while positive factors like strength, faith, and self-efficacy positively influence start-up plans (Abu Bakar et al., 2017; Jin, 2017). Positive psychological capital is strongly associated with start-up intent.

The Main Objective of the study can be elaborated as follows.

1. To discover how psychological and financial stability affect start-up decision-making for start-ups that use external funding at the initiation level.
2. Investigate the level of public awareness of support programmes and services the government provides for start-ups and entrepreneurs.

## IV. SIGNIFICANCE OF THE STUDY

Entrepreneurs with potential face challenge in managing finances and need more expertise. This research examines the role of government and bank finance institutes in strategic decision-making in initiating start-ups and how age and psychological factors affect the introduction of start-ups. Sri Lanka, a developing country with a 91.7% literacy rate, has the potential for emerging entrepreneurs to launch their start-ups. The research addresses practical problems start-ups face from banking finance and government aspects.

This research addresses a gap in Sri Lankan entrepreneurship and start-ups, focusing on psychological factors and their impact on enterprises. During the pandemic, the study utilizes modern technological platforms, making it significant in data collection methods among existing research. The findings will benefit start-up owners, entrepreneurs, the government, and future researchers in understanding the impact of psychological factors on enterprises.

This research aims to help future entrepreneurs, start-ups, and government sector officials understand and address new challenges during the pandemic. It covers small and medium-sized enterprises, making it useful for all business stakeholders, regardless of time gaps. The research empirically covers all aspects of small and medium-sized enterprises, making it a valuable resource for entrepreneurs and stakeholders.

## V. LITERATURE

### A. *Relationship between bank finance and government support initiation of entrepreneurship in Sri Lanka*

Limiting access to funding sources hinders Sri Lanka's entrepreneurship and start-up development, resulting in entrepreneurs relying on personal savings, debt, and bootstrapping (Kuruppu, 2015). Barriers such as lack of collateral, poor financial relationships, high-interest rates, and complex procedures further exacerbate the situation. The formal financial system needs more supportive policies to assist, leading to the emergence of semi-formal and informal sectors as alternative sources of finance. Government initiatives and financial institutions aim to support SMEs, but high-interest rates and low achievability impede access to guidance and credit. Acquiring traditional financing or equity is challenging due to contemporary banking methods and societal norms, leading entrepreneurs to borrow from high-interest sources. The government is introducing additional initiatives to address these issues (Kuruppu, 2015; Perera, 2019; Jayawardane, 2016).

Entrepreneurship development in Sri Lanka is hindered by limited access to funding and finance, as the existing banking and debt models have collateral requirements and high costs (Zaidi et al., 2021). The governing political party and the major opposition political party prioritise economic progress but differ in their approaches to encouraging economic improvement after the civil war (Sarvananthan, 2011a). The post-war economic restoration strategy in the east and north of Sri Lanka relies heavily on government-funded projects with contributions from bilateral and multilateral donors (Sarvananthan, 2011b). The government can promote women's entrepreneurship in the Northeast by providing support such as loans, subsidies, microcredit financing, skills training, and business consultancy (Snyder, 2003a). It is suggested that the government should implement neutral policies, amend legal backgrounds and legislation based on firm size, and focus on promoting exports, increasing employment opportunities, and shifting towards meritocracy (Smallbone and Welter, 2001; Chatterjee et al., 2019). Researchers have developed hypothesis 1 to test this relationship.

H1- Bank finance and Government support positively affect the initiation of the entrepreneurial firm.

### B. *Impact of entrepreneur's age on the access to government support in initiating entrepreneurship.*

The impact of an entrepreneur's age on accessing government support in initiating entrepreneurship is a significant consideration. The general equality duty mandates that central and local government must not unlawfully discriminate and work towards removing discrimination and promoting fairness and equality among individuals with protected characteristics, including age.

The United Nations monitors government adherence to such duties (Anon, 2016). In Sri Lanka, elderly financial support includes state pension schemes for public employees and specific groups in the private sector, mandatory provident funds, and social assistance transfers primarily targeted at older people. These programs are funded through general revenue taxation, although the financial capability of some schemes has declined in the past decade, necessitating increased reliance on taxation. Additionally, poverty reduction programs like Samurdhi and Pin Padi provide cash benefits to eligible households, with a portion benefiting older people. The Elderly People Allowance is a prominent cash transfer program established in 2012 to support poor elderly individuals. In 2016, it served 386,000 people aged 60 and above, providing SLR2,000 per month to qualified recipients aged 70 or above, with a monthly income of less than SLRs3,000, living alone or with a partner but not with children (Bank, 2019). Sri Lanka faces challenges in achieving SDG 8 and reducing unemployment, particularly in rural areas with limited computer literacy and ICT infrastructure. The curriculum mismatch with the job market and issues such as lack of oversight in apprenticeships and recognition of professional qualifications by companies pose further obstacles. The government offers apprenticeships, internships, and professional training but needs to address these challenges effectively.

H2- The age of the entrepreneur moderates the relationship between bank finance and government support in initiating a start-up or entrepreneurial firm.

### C. *Psychological Factors*

Entrepreneurship decision-making is often rational, with subjective factors excluded (Barlach, 2020). However, psychological factors, like AJZEN's Theory of Planned Behaviour (TPB), play a crucial role in creating new firms. TPB emphasises intention as a strong predictor of subsequent behaviour, highlighting the importance of intention in entrepreneurship (Kibler et al., 2014). Psychological factors significantly influence entrepreneurship and startups, with individuals with stronger willpower tending to succeed (Kibler et al., 2014). Ethical recognition and perceived advantages increase confidence in entrepreneurship, strengthening intentions (Kibler et al., 2014). Cultural, socioeconomic, and regional social legitimacy also influence psychological conditioning, with higher societal and cultural lawfulness resulting in greater perceived entrepreneurial ability and increased entrepreneurial activities. Psychological characteristics are crucial for determining entrepreneurial intentions and contributing to success (Chatterjee and Das, 2015). Eight psychological factors predict startup success: need for accomplishment, self-efficacy, tolerance of

uncertainty, locus of control, risk-taking tendency, innovativeness, independence and autonomy, and optimism (Frese et al., 2002). These factors are closely linked to startup performance and success. Psychological traits also play a significant role in women's entrepreneurship, forming the foundation for becoming business creators (Max and Ballereau, 2013). Higher levels of self-motivation and risk-taking abilities are associated with better entrepreneurial skills, and there is a positive correlation between psychological variables and entrepreneurship success (Chatterjee and Das, 2015). Psychological factors, such as innovativeness, significantly influence entrepreneurship and startups (Journal and Apr 2015). Innovativeness involves a company's ability to engage in new ideas, research, and creative processes, leading to new products, services, or technological procedures. This is a crucial component of entrepreneurial orientation, allowing businesses to seek new opportunities (Lumpkin and Dess, 1996). Entrepreneurs employ competitive strategies, such as introducing new products, developing new markets, or restructuring production processes, to stay ahead of the competition (Mueller and Thomas, 2001). Understanding these psychological factors is essential for entrepreneurs in decision-making and developing successful ventures. To test the effect of above mentioned psychological factors on the initiation of an entrepreneurial firm researcher developed hypothesis 3 as below.

H3 – Psychological factor positively affects the initiation of the entrepreneurial firm.

#### *D. Impact of the age of entrepreneur with psychological factors in initiating entrepreneurship.*

Coping is a crucial response to entrepreneurs' challenges and pressures in their business ventures. They often alternate between actively addressing venture issues and temporarily distancing themselves from problems to manage venture-related stress effectively. Given the uncertain and volatile environments in which entrepreneurs operate, coping and psychological well-being (PWB) play vital roles. Adaptability is closely tied to overall performance, and as entrepreneurs typically engage in direct business management, their coping strategies can significantly impact the success of their endeavours. Despite the importance of coping and PWB, there needs to be more empirical research on these topics in the context of entrepreneurs. Existing studies mainly indicate that entrepreneurs experience higher stress levels than non-entrepreneurs due to ambiguous and ever-changing entrepreneurial environments. Previous research by Gumpart (1983) focused on the sources of entrepreneurial stress inherent in self-employment. Shepard (2003) specifically examined the highly stressful event of business failure and proposed a dual-process recovery model. These

studies have shown that coping behaviours partly mediate the impact of career choice (self-employment versus employment) on negative emotions like fear and anxiety. However, it remains to be seen how entrepreneurs' coping behaviours relate to their PWB and the specific conditions and circumstances in which these relationships exist. Enhancing PWB is crucial for entrepreneurs as it improves their ability to utilise emotional and cognitive skills, ultimately influencing their performance and productivity in running their business ventures. Further exploration of the relationship between coping behaviours and PWB will be conducted during the hypothesis evaluation process. This research sheds light on the interplay between coping, PWB, and entrepreneurial outcomes, providing valuable insights for entrepreneurs to manage their businesses effectively. To test the Age of the entrepreneur moderates the relationship between psychological factors on the initiation of a start-up or the entrepreneurial firm researcher developed hypothesis 4 as below.

H4 – The age of the entrepreneur moderates the relationship between psychological factors on the initiation of a start-up or the entrepreneurial firm.

The government will encourage the distribution of investments into business stocks that will lay the foundation for the future growth of the national economy. Georgia's underdeveloped financial market allows for the attraction of international portfolio investments. One of the most crucial metrics for assessing a country's economic viability is its stock exchange indexes. When stock indices decline, it indicates bad economic prospects for the nation. The expansion of this market and the activation of the securities system are two important ways to draw investment capital into the economy. One of the most crucial prerequisites for the growth of the economy in Georgia is the development of the securities market. This market encourages the accumulation of capital and its incorporation into the process of economic growth.

Georgia's current financial market situation. Problems. The mechanism of securities is activated as one method for attracting investment money. These markets allow for the trading of shares, bonds, currencies, derivatives, and bank credits. Analysts claim that the years 2007 through 2015 were challenging for Georgia's corporate securities market on all counts. Three specific occurrences in the years 2007 and 2008 that inhibited the achievement of mature prospects during the market-building process must be anticipated. Global financial crisis, August War, and the "Third Phenomenon"—a collection of radically altered securities market laws—are these phenomena. Along with being supplied in the context of "liberalization" at the time, these changes also came with a sharp loss in transparency.

Therefore, Georgia's securities market's current negative situation is "self-provoking" in a special way. The desire for trading securities that could only be done through stock exchanges was eliminated by the changes made in 2007.

The implementation of the modifications, not their intent, was the issue. The adjustments did not result in the obligation to execute transactions requiring the brokers to be in the best condition, nor was the stock exchange the power to demand that members execute transactions solely at the stock exchange. Specialists claim that as a result, trading dramatically shifted away from stock exchanges and into non-stock markets and securities registrars (Vardiashvili M., 2016).

The moderator function of third variables, divides a central independent variable into subgroups that find its provinces of maximal effectiveness with respect to a specified dependent variable, and the mediator function of a third variable, signifies the propagative mechanism over which the central independent variable is able to impact the dependent variable of interest (Baron & Kenny, 1986).

A moderator is, in general, a qualitative or quantitative variable that modifies the relationship between an independent or predictor variable and a dependent or criterion variable in terms of its strength and/or direction. A moderator is a third variable that influences the zero-order correlation between two other variables in a correlational analytic paradigm (Baron & Kenny, 1986).

When it comes to the hypothesis and variables of the research,

H2 - The age of the entrepreneur moderates the relationship between bank finance, government support, and the initiation of a start-up or entrepreneurial firm.

According to the regression test conducted in this study, the significance value is 0.000 indicating that is significant. The idea that the age of the entrepreneur moderates the link between bank funding, government support, and the commencement of a start-up or entrepreneurial business is proven by these results.

H4 - The age of the entrepreneur moderates the relationship between psychological factors and the initiation of a start-up or entrepreneurial firm.

According to the regression test, the significance value is 0.804 which is greater than the acceptable significant value (0.05). Hence the age of the entrepreneur does not moderate the relationship between the psychological factor and the initiation of a start-up or entrepreneurial firm.

Entrepreneurial ventures and start-ups during Covid-19 in a global perspective.

Global society and economies are going through an unprecedented external shock as a result of the discovery of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in late 2019 (Zhu et al., 2020) and the following COVID-19 pandemic that followed (JHCRC, 2020). Any other event has been overshadowed by the virus's rapid and disruptive spread and its horrific repercussions. More and more nations, including established, developing, and emerging ones, are catching on to it. The economic repercussions are also very substantial. Initial predictions predict that this will be even worse than the recent financial crisis of 2008–2012, making it the worst economic disaster since the Second World War. Additionally, the consequences for entrepreneurship and new business activity appear to be getting worse. Despite the fact that the situation is unheard of, we may draw lessons from the past crisis and the available research to pinpoint some of the general effects and more specifically the effects on entrepreneurial activity (Liñán & Jaén, 2022).

There are some major factors that affect starting entrepreneurial ventures during Covid-19 pandemic era. Both the supply-side (harder access to resources) and demand-side (few clients willing to purchase goods or services) of the Covid-19 crisis have had a severe negative impact on entrepreneurship. The primary locations and sources of opportunities have changed as a result of this. Demand-side effects concentrate on a decline in total demand, with three primary causes: long-term adjustments, limitations on routine activities, directives from the government, travel limits, and higher population concentrations. Entrepreneurship depends on quickly acquiring a sizable consumer base, yet direct communication with customers may grow more challenging (Liñán & Jaén, 2022).

Consumer spending is being negatively impacted by the economic crisis, which is also causing a decline in GDP and employment. The International Monetary Fund estimates that the GDP of industrialized economies will decline by 6.1%, while that of emerging markets and developing economies will fall by 1.0%. In most advanced economies, the unemployment rate is projected to increase by 25–50%, with the euro area countries suffering a 39% increase. Forecasts from national governments are making the situation worse, with emerging economies going through a milder recession as a result of Covid-19's less significant effects. As a result, consumer demand will suffer, leading to decreased income and decreased aggregate demand (Liñán & Jaén, 2022).

Apart from that, the government can focus on some new opportunities as well during pandemic. Opportunities in health products, protective gear, biochemistry and biomedicine, and new enterprises are presented by the



Covid-19 crisis. For the virus and prospective new viruses, there is a great demand for new testing, medications, and vaccines. By enabling entrants to enter these marketplaces with enhanced or novel goods or services, the pandemic also indirectly benefits new enterprises in sectors including online services, e-commerce, remote working, distant learning, education, software solutions, and third-age care services (Liñán & Jaén, 2022).

Impact of bank finance and government support on initiating entrepreneurial ventures and start-ups during Covid-19.

The epidemic will undoubtedly have a significant impact on entrepreneurial activities. In order to help potential, emerging, and new entrepreneurs survive, a number of actions could be implemented (Giotopoulos et al., 2017). This could involve measures to make it easier to use unemployment benefits in new business ventures, the preservation of social and welfare benefits in the event that a person starts a new company, etc. However, it is important to be mindful that these actions will encourage the formation of entrepreneurs who are primarily motivated by necessity. Therefore, it is anticipated that the overall impact on the GDP and employment will be extremely little. According to the degree of economic independence (McMullen et al., 2008) and state fragility (Amorós et al., 2019) in the case of emerging nations (Liñán & Jaén, 2022).

The implementation of these policies will be difficult due to legislative delays and a lack of funding for new businesses and enterprises. Budget restrictions affect public funding, and high perceived risk may deter private capital from investing. To ensure a speedy recovery from the Covid-19 crisis, central banks and national governments have taken action to avert liquidity issues and credit constraints. It will be necessary to consider long-term effects, such as public deficits, debt, and an expansion of the money supply, particularly for rising and developing nations with high debt levels (Liñán & Jaén, 2022).

Organizational resilience with the support of government and bank finance for entrepreneurial ventures and start-ups during Covid-19

The resilience viewpoint is a comprehensive method for examining how a system responds to crises, bounces back from them, and adjusts to novel situations. It also looks into preventative measures including situation awareness, risk forecasting, and vulnerability management. Researchers in public sector accounting have used the idea to examine how governments manage budget cuts and austerity measures. The resilience approach encapsulates the mechanisms that underlie governmental responses to crises, showing how internal and external elements

combine to deal with financial shocks and create vulnerabilities. Governmental financial resilience depends on a limited understanding of coping and anticipating skills, and changes in how these skills are combined through accounting may lead to differing reactions to shocks (Upadhaya et al., 2020).

Government debt in Bhutan, Sri Lanka, Pakistan, and the Maldives amounts to more than half of each country's GDP. Following COVID-19, all South Asian countries' general government debt to GDP ratios are expected to rise significantly, according to Fitch Ratings. Situations with high debt levels impede effective COVID-19 responses and constrict possibility for growth. According to the regional growth prediction, the region's GDP will shrink by up to 2.7% in 2020, between 1.8 and 2.8%. Four of the countries in the region are anticipated to have negative growth and significant financial challenges (Upadhaya et al., 2020).

Sri Lanka's efforts among the South Asian nations appear to have been successful in halting the virus's spread and reducing the number of fatalities. The pandemic, however, has exacerbated the financial resilience and further undermined the nation's already precarious and indebted economy. The government's first course of action was to borrow money from outside sources, even going so far as to increase the already high level of external indebtedness. The administration reportedly used every resource it could find to raise money to combat the pandemic, according to international media (Upadhaya et al., 2020).

South Asian governments, like India, Nepal, and Sri Lanka, have been reactive in financial resilience, but there is a gap in understanding the problem and developing financial resilience. To revitalize the region's financial resilience, governments should avoid austerity and cutback management, addressing child poverty, food banks, affordable housing, and public services spending. To build long-term financial resilience, governments should launch resilience-building processes, enhance organizational capacities, and consider mandatory reserves, fiscal autonomy policies, and revenue diversification (Upadhaya et al., 2020).

The COVID-19 dilemma has brought to light the significance of studies on entrepreneurship finance, including entrepreneur motivation, venture capital networks, and angel investor networks. Policymakers are becoming more and more interested in opportunity-driven entrepreneurs, and networks for entrepreneurship may be essential for locating funding for entrepreneurs. For academic academics and policymakers, it is essential to examine performance effects and the implications of different financial sources on long-term entrepreneurial performance, survival, and growth. The government and

policymakers may want to design financial policy interventions that lessen the effects of the pandemic on small businesses, focusing on subgroups, supply chains, and small businesses without stable bank relationships. Financial support policies are essential for supporting small businesses and individual entrepreneurs (Belitski et al., 2022).

### V. CONCEPTUAL FRAMEWORK

Based on the theoretical background in the literature review section, a conceptual framework has been developed to conduct the empirical study.

This research examines two independent variables, Bank Finance and government support and psychological factor, considering age as the moderator. Long with those variables, there are 09 sub-variables. The dependent variable is the initiation of the start-up and entrepreneurial firm. This research examines how each sub-variable is associated with the independent, moderator, and dependent variables. The questions were developed as five-point Likert Scale questions.

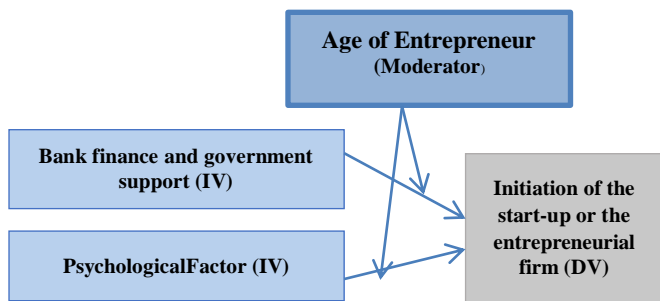


Figure 1. Conceptual framework  
Source: Authors (2021)

### VI. RESEARCH METHOD

#### A. Research Design

The research design is exploratory. Data will be collected both from primary sources and secondary sources. Interviews, observation, and questionnaires were used to collect primary data. The quantitative data for the study is expected to be collected by using the structured questionnaire method with the use of Google Forms. Secondary data was collected from articles, journals, books, websites, magazines, etc.

#### B. Sample Design

According to the Morgan Table, the researchers have taken 278 Start-up owners and entrepreneurs of the Homagama Divisional Secretariat of Colombo District as the Sample for the study.

#### C. Population

The target population for this study is Start-up owners and Entrepreneurs in Homagama divisional secretariat. The researchers have identified Small and Medium Scale enterprises that started within less than five years as Start-up enterprises.

### VII. ANALYSIS

#### A. Correlation

When the values for the correlation are considered between two independent variables, it is observed that there is a correlation size of only 0.082, which is negligible with a p-value of 0.245. Therefore, further research proceedings can be carried out without a relationship between the independent variables. Thereby, multicollinearity is negligible.

i. Correlation between bank finance and government support initiation of entrepreneurship in Sri Lanka:

The Pearson correlation coefficient between BFG and DV is 0.197. The p-value associated with this correlation is 0.005 since the correlation between bank finance and government support initiation of entrepreneurship is statistically significant at a conventional level of 0.05. We can assume that bank finance and government support significantly affect the initiation of entrepreneurship in Sri Lanka.

ii. Correlation between Psychological factors and initiation of entrepreneurship in Sri Lanka:

The Pearson correlation coefficient between PF and DV is 0.453. The p-value associated with this correlation is <0.001 since the correlation between Psychological factors and initiation of entrepreneurship in Sri Lanka is statistically significant at a conventional level of 0.05).

#### B. Multiple Regression Analysis

Bank finance, government support, and psychological factors are independent variables. At the same time, the age of the entrepreneur is the moderator, and the dependent variable is the initiation of the entrepreneurial firm. The probability of F-test statistics of the regression ANOVA is highly significant as the P value is 0.000. This means the model is jointly significant, and the independent variable influences the dependent variable. The model is appropriate.

Multiple correlations “R” is 0.983. This says a strong joint association exists between independent and dependent variables. R-square is 0.965 with a statistical significance of  $P < 0.5$ . This indicates that the model has covered 96.5% of the initiation of entrepreneurial firms (dependent variable). The regression model is nicely fitted as the value exceeds 60%. Adjusted R-square also represents the model covering 96.5% of the dependent variable.

### C. Coefficients

According to the results, bank finance and government support have a positive and significant impact on the initiation of entrepreneurial firms because the beta coefficient of this variable is significant at a 5% significance level where the significant value is 0.000. Psychology factors do not have a positive and significant impact on the initiation of entrepreneurial firms because the use beta coefficient of this variable is not significant at a 5% significance level where the significant value is 0.688. The age of the entrepreneur moderates the impact of bank finance and government support on the initiation of entrepreneurial firms because the significance value is 0.000. The age of the entrepreneur does not moderate the impact of psychological factors on the initiation of entrepreneurial firms, as it has a significant value of 0.804.

As the psychological factor and the interaction of moderator age with psychological factor were insignificant, researchers ran another multiple regression analysis using significant variables earlier. The probability of F-test statistics of the regression ANOVA is highly significant as the P value is 0.000. This means the model is jointly significant, and the independent variable influences the dependent variable. The model is appropriate.

Multiple correlations "R" is 0.982. This says a strong joint association exists between independent and dependent variables. R-square is 0.965 with a statistical significance of  $P < 0.05$ . This indicates that the model has explained 96.5% of the initiation of entrepreneurial firms (dependent variable). The regression model is nicely fitted as the value exceeds 60%. Adjusted R-square also represents the model covering 96.5% of the dependent variable.

## VIII. RESEARCH FINDINGS

The independent variables of bank finance and government support, as well as the indicators of Government bank loans, Private bank loans, Tax relief, and Government policies, have all been included in this study. When specific sub-variables are considered, good correlation coefficients can be found. According to prior studies, entrepreneurs in developing countries confront more obstacles than those in other established countries. They must first cope with insecure and bureaucratic corporate settings. Second, the rules regulating private activity, particularly those controlling business registration and taxation, are complex and difficult to comprehend. Third, contract and property laws could be more effectively conceived and better implemented. Inadequate infrastructure, weak macroeconomic policies, restricted access to financial resources, corruption, and a lack of management expertise are major issues entrepreneurs in transition countries face (Chu et al., 2011). Financial

literacy may significantly predict financial access (Fernando, Cole, 2008; Sherman et al., 2007). Clients may be unwilling to acquire a product whose utility they only partially grasp if they have low financial literacy. This may impede the uptake of increasingly sophisticated financial goods such as insurance. (De Mel et al., 2012) Suggests that gaining financial literacy via the development of business skills is a significant driver of SMEs' growth and a factor of productivity. Financial literacy, defined as the "capacity to receive, comprehend, and assess the essential information necessary to make financial decisions and choices while being aware of the potential financial repercussions," is crucial for SMEs in emerging economies to have access to financial services. Individuals with financial literacy abilities, according to (Njoroge and Kisaka, 2014), make better financial judgments and make fewer management mistakes than those who are financially illiterate. Financial literacy skills empower and educate SME owners, allowing them to assess financial products and make educated decisions. Moreover, financial literacy improves SMEs' risk management abilities. Financial literacy, according to (Siekei, 2013; Candiya Bongomin et al., 2018), prepares SMEs owners for difficult financial times by using risk-mitigation techniques such as saving, diversifying assets, and avoiding excessive debt (Okello et al. et al., 2017) (Candiya Bongomin et al., 2018). It maBankncing and government backing can have a direct impact on directly impact a business's start-education is important for senior entrepreneurs due to opportunity, but not for other age groups or motives. This research's uniqueness is a significant contribution. As a result, education is a factor that governments should pay greater attention to (Home OECD, 2016). Sri Lanka provides free education to its citizens. Here the sample is taken; by 2015, 100 per cent of t; ample will be able to read and write because the answers collected in this study indicate this factor. Since a telephone is being used, this statement is true.

The creation of policies that tend to contribute to better gender equality for all age groups in the country is linked to the strengthening of women's entrepreneurship through opportunity (Home OECD, 2016).

Financial service providers, particularly banks and financial institutes, should target low-income SMEs when promoting their financial services. They should develop new creative SME goods, give high-quality service, and supply SMEs with non-standard office hours. Policymakers should establish favourable conditions for low-income SMEs to access bank loan facilities, such as lowering interest rates, relaxing collateral requirements, lowering banking expenses, and boosting competition between current banks and SMEs-focused banking products.

This study implies a significant impact of bank finance and government support on initiating entrepreneurial firms. This relationship was significant at a 0.000 significance value where  $P < 0.05$ . Moreover, the results revealed that there is a significant as well as positive relationship between the two mentioned variables (Kibler et al., 2014). They used follow-up tests to assess the pairwise differences between the means. Dunnett's test was used to make a post hoc comparison. There were substantial variations in the mean between the age groups of 36-44 and 55 years and older in the entrepreneurial competency cluster. There was also a significant difference in the means between the age groups of 36-44 years old and 55 years and older and between the age groups of 26-35 years old and 55 years and older within the personal and relationship competency cluster. Although age detrimentally influences requirements and opportunities, the chances of diminishing entrepreneurial activity at one age are quite slim. Some authors agree with this. Even after accounting for other company and national characteristics, bank financing is progressively growing, whereas informal finance gradually declines with age, according to global bank data (L. et al. et al., 2011). According to the tests, these trends are not explained by differences in company composition or country-level factorisation (L. Chavis et al., 2012) investigated the link between company age and institutional features at the country level. For example, bank financing is more common in nations with a better rule of law and more credit information. In contrast, informal finance is more common in countries with a weaker rule of law and less credit information (L. Chavis et al., 2012).

According to the regression test conducted in this study, the significance value is 0.000, indicating that it is significant. The idea that the age of the entrepreneur moderates the link between bank funding, government support, and the commencement of a start-up or entrepreneurial business is proven by these results.

This variable was considered with the indicators of locus of control and innovativeness. Psychological factors are considered the primary determinants of entrepreneurial intention among entrepreneurs. Psychological variables can be regarded as one's self-perception – sometimes known as self-perception – and how society views one. 237 EI of senior university students on how someone views the process of establishing a business and personality factors that influence perceptions (Zhao et al., 2021). Assumed that a society with a high overall level of accomplishment motivation will generate more active entrepreneurs, who, in turn, will produce faster economic growth. The claim that achievement motivation is the psychological mediator between Protestantism and economic progress (Weber, 1948; Abu Bakar et al., 2017) is considered to have sparked the quest for “personality traits of the successful

entrepreneur” (Chatterjee et al., 2019). Some entrepreneurial qualities, such as a strong proactive personality, the internal centre of control, and a high-risk proclivity, favourably impact a person's assessment of a prospective new business opportunity (Yan, 2010) (Eid et al., 2019). In contrast to popular belief, a high achiever does not necessarily perceive a possible venture opportunity more favourably than a non-high achiever, according to this study (Yan, 2010). Even though these suggestions have been made since the 1980s, the new focus on effect size, confidence intervals, and meta-analysis (together with or instead of statistical significance tests) is frequently referred to as The New Statistics (Cumming) in psychology. Even though they are simple to inclinations to include confidence intervals and effect sizes have been sluggish to gain hold. Many confidence intervals are “embarrassingly vast,” and many obtained effect sizes are “embarrassingly small,” according (Cohen, 1992). Unfortunately, for many analyses, SPSS does not give effect size indices (there is no reason why this could not be). Users of tools like SPSS should know that obtaining general information frequently necessitates some (usually minor) manual calculations. The Watson paper is a nice place to start. Setting reasonable confidence intervals for effect size estimates is doable (albeit time-consuming). The distinguishing psychological factor among entrepreneurs is the perception of their ability to leave their group and start up a new business alone (Saldaña et al., 2015), called autonomy.

With the results, it shows a 0.668 significance value which is more than 0.05. According to statistics, the null hypothesis is acceptable. According to the regression test, the significance value is 0.804, greater than the acceptable significant value (0.05).

In both pure and applied investigations, behavioural scientists in general, and notably psychologists with substantial interests in individual variations in personality, attitude, and ability, commonly use correlational analysis as an investigative technique. The Pearson product-moment correlation coefficient,  $r$ , is the most widely used statistical technique for expressing the relationship between two variables. The truth is that most behavioural science is still in such a state of development that minimal variance in the dependent variable is predicted. This is another way of saying that the behavioural sciences are less sophisticated than the physical sciences (Morphology, n.d.). Finally, age was determined not to impact a person's impression of a new enterprise possibility. This shows that young individuals may only sometimes consider establishing their own business more attractive or possible than older people. According to (Yan, 2010), majmostreneurs begin their businesses between the ages of 30 and 50. According to recent surveys, entrepreneurship is

becoming a viable option for adult Americans of all ages (Lopes et al., 2018).

Trait psychologists were more interested in evidence of stability than gerontologists. Even though the literature findings proved that age moderates the link between psychological factors and the commencement of a start-up or entrepreneurial business, with the findings of this research, that idea was disproved. So, the null hypothesis is acceptable.

## IX. DISCUSSION

### A. Conclusion

This study aimed to identify the requirements for establishing entrepreneurial ventures and start-ups, contributing to a country's economic development. A literature review provided a strong theoretical foundation, and the methodology was designed to achieve research objectives. Data analysis confirmed three out of four hypotheses, with the null hypothesis regarding the impact of psychological factors on the initiation of entrepreneurial firms. The findings suggest that bank finance and government support positively impact entrepreneurial firm initiation, while psychological factors show a negative relationship. Age was identified as a moderating factor influencing the impact of psychological factors, bank finance, and government support on firm initiation.

Bank finance and government support were the most influential factors, emphasising the importance of external support for entrepreneurs. Although less impactful, psychological factors can still influence healthy functioning through individual experiences.

### B. Limitation of the Study

The study faces limitations due to limited data access, time constraints, and sample bias. The COVID-19 pandemic restricted interviews, limiting data availability. The sample size was limited to entrepreneurs and start-up businesses in a specific region, and online data collection faced challenges, especially among individuals over 55 with limited knowledge of technical devices.

### C. Suggestions and Recommendations

The study highlights the importance of prioritising factors influencing entrepreneurial ventures and start-ups. Governments should establish favourable policies and create a supportive environment for start-ups, such as reducing interest rates, easing collateral requirements, and lowering banking costs. Emphasising entrepreneurial education can foster innovation and support venture growth. Future research should address other issues and factors affecting entrepreneurial activities and start-ups to improve the quality of ventures and lead to personal and economic growth. Further research is needed to explore the

relationship between bank finance, psychological factors, and the business sector. Overall, the study provides valuable insights into the impact of bank finance, government support, and psychological factors on entrepreneurial ventures and start-ups.

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# A Comparative Study on the Opportunities and Challenges of Blockchain Implementation in Logistics and Supply Chain Operations in Sri Lanka

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**Abstract** - The world is evolving and moving forward with Industrial 4.0 and its implications such as Blockchain Technology. However, its application in Sri Lanka is still in an infant stage. The study aims to compare the Blockchain implementation in logistics and supply chain operations and find out the similarities and contradictions in the opportunities and challenges, most importantly the opinions, suggestions, estimations from the relevant industry professionals. In-depth interviews were conducted with seven industry professionals from logistics and supply chain operations using the simple random sampling method. Discourse Analysis was used to find out the similarities, contradictions and special points which were pinpointed by the industry professionals. The study suggests the opportunities for new business models, creating leading solutions for end customers, generating solutions that are hard to imitate by a third party, decreased cost through the interconnected system, ability to increase quality and traceability and reduction of documentations and administration in an organization. As challenges the study highlights the capital requirement in implementation, negativities of standardization, losing the direct value creation of the end customer and losing the organization's flexibility. In conclusion, the study highlights that there are many challenges in comparison with the opportunities in implementing Blockchain Technology to the logistics and supply chain operations in Sri Lanka.

**Keywords:** *Blockchain Technology, Logistics, Supply Chain Management*

## I. INTRODUCTION

In recent advancements and research, technology update is heavily dependent on automation based on the internet; in Sri Lanka, however, industrial automation in the logistics and supply chain operations lags well behind that of developed Asian nations. Industry revolution 4.0 offers a practical and focused strategy to address these demanding objectives (Arnold et al., 2016; Kiel et al., 2017). Logistics and Supply Chain Management (SCM) are rapidly changing and developing with new technological advancements. In the new business world, the most recent trend is Supply Chain 4.0. Growing attention is being paid to the implications of Blockchain Technology and services of Blockchain Technology into industrial value creation in

the context of logistics and supply chain operations in Sri Lanka.

The phrase "Industry 4.0" is becoming a more essential topic in this new industrial period setting (Barreto et al., 2017). One of the key effects of this new industrial revolution is Blockchain Technology. Blockchain Technology is a network of connected computer systems that contains multiple copies of a digital log of transactions. Blockchain Technology is a uniquely groundbreaking and promising technology because it offers expandable visibility for a range of applications while lowering risk and eradicating fraud (Awwad et al., 2018). Although Blockchain Technology is not well understood, it is a hot topic in the media right now and is growing quickly as a medium. There are very few academic articles on Blockchain Technology, which should undergo recurrent updates. Blockchain Technology has become a potentially revolutionary, all-purpose tool for businesses looking to boost trust in their interactions with one another (Yli-Huumo et al., 2016).

In Sri Lanka, Blockchain Technology is not extensively used, there is a knowledge gap, and only a small number of business professionals are keen to offer their insights on the technology to the general public, according to an analysis of the articles. On one side, it guarantees to offer logistics and supply chain operations successful business models, higher enhanced productivity, quality, and working environment. Similarly, logistics and supply chain operations display reluctance to implement Blockchain Technology due to the lack of clarity on challenges and opportunities.

According to Kiel et al (2017) a differentiated study of the various firm sizes, industrial sectors, or manufacturers' roles as providers or users of Industry 4.0 solutions is particularly lacking in the current conversation. Therefore, this study addresses this contemporary concern and build a platform for professionals in logistics and supply chain operations to connect to a world where they can learn more about or enhance their understanding of Blockchain Technology, its opportunities and challenges. Accordingly, the main objective of the study was to identify the similarities and contradictions on opportunities and challenges in implementing Blockchain Technology to logistics and supply chain operations in Sri Lanka.

## II. METHODOLOGY

This research was focused on interpretivism philosophy, and a qualitative study is conducted by the researchers. As for the research approach, the study has used an inductive approach whereas the research strategy is the interview method. The research choice was the mono method, and the time horizon is cross-sectional. Seven industry professionals in top level and middle level management were used in the sample out of which three are female professionals. Data collection was conducted through e-mailed questionnaires and interviews via Zoom which last between 90 and 120 minutes. Data analysis was conducted using Discourse Analysis as expressions, opinions, views and thoughts of speakers and the use of language can be correctly analyzed (Mogashoa, 2014; Hodges et al., 2008). Secondary data was collected from journal articles, magazines, newspapers, and reports.

The seven interviewees were given identification numbers as General Manager - IT Department (ID 01), Supply Chain Director (ID 03), Head of Logistics and Customer Service (ID 03), Head of Planning (ID 04), Head of Procurement (ID 05), Head of Department – Academic (ID 06) and Manager - Project Management Office (ID 07).

The overall idea of each interview was summarized into statements to compare and identify the similarities and contradictions of opinions among the interviewees. The comparison was conducted separately for opportunities; strategy and operations and challenges; competitiveness and future feasibility and organizational and production fit. The findings were illustrated through a tabular analysis for convenience in interpretation.

## III. RESULTS AND DISCUSSION

According to the literature, industry 4.0 provides significant strategic advantages for business structures. These involve the creation of new business models as well as modifications to established corporate structures. Businesses can leverage these services to offer highly personalized solutions (Müller et al., 2018). These new business models that are driven by data, technology, and digital logic will accelerate the removal of the boundary between the production of goods and the supplies of services following responses will give evidences.

*“Yes, with Blockchain Technology being implemented to our organization, the company was able to create a new business model and adopt to a product which will help our company to provide the required information to our customer’s customer fingertips. In your words, which will also lead the company to solve whatever the problem the customer may have. As we are the first to implement this product to our company, our competitors will have a hard time adjusting to it” (ID 01).*

*“Blockchain may enable new business models to ease up the process. However, gathering this data and market insight is easy, absorbing the analyzed information into the system is challenging. Difficult to make quick shifts Blockchain ledgers create an end-to-end transparent picture” (ID 04).*

*“Another fact is that all the data and information has been end-to-end encrypted. Which will ensure that information will not be accessed by outside people” (ID 01).*

Industry 4.0 has a significant impact on business models since this new manufacturing paradigm necessitates new supply chain communication channels (Pereira & Romero, 2017). According to ID 01 and ID 04, the companies have been able to create new business models and to solve end customer problems just by implementing Blockchain Technology. However, Sri Lankan companies have had issues while trying to integrate individual data into the Blockchain system. The deployment of new manufacturing technologies and production processes associated with Industry 4.0 is influenced favorably by their operational potential (Müller et al., 2018).

*“Yes, for a fact, somewhat documentation has been reduced after adopting or as for your study implementation of Blockchain . And, I must add we are still in the implementation process with that we cannot identify any cost reduction” (ID 07).*

*“By adopting to any technological advancements will provide any organization with cost reduction, however, with adopting or implementing Blockchain Technology to any organization long term cost reductions can be seen, it will be hard to trace any short-term cost reductions” (ID 06).*

The cost-benefit analysis of implementing Blockchain and understanding the short-term and long-term benefit is somewhat questionable as per the interviewees.

For instance, new competitors offering connected and smart product solutions or even whole new business models, such platforms, could quickly emerge and impact the current market position of established enterprises. Similarly, increasing competitive dynamics and facilitated market entry of new competitors rank among the most important issues in the industry 4.0 era (Müller et al., 2018).

*“Customers expect trustworthy companies, through client interaction, businesses may build greater customer trust and raise the value of their products. However, with Blockchain Technology been implemented the value creation for the end customer may have decrease from a certain amount, from the customer perspective. Because a resource person won’t be able to meet with the end customer as every transaction has been digitalized with the help of Blockchain Technology. With that the connection between the vendor and the end customer may lose its connectivity at some point” (ID 05).*



“It is not always about creating value with your customers the companies should be able to give more to their customers and environment within this globalized world. That is what a growing company should focus on” (ID 04).

“End-to-end Blockchain integration for Sri Lanka is a farfetched reality given the costs of implementation. However, developments may come forth in the upcoming years maybe in 2030 due to the technological skewness with Sri Lanka government. Interest of authorities support companies to bring in tech to the market. With the lack of interest and low standards of the government sometimes, the companies feel like not implementing Blockchain Technology” (ID 07).

It is revealed that some of these technological developments may occur in 2030, and with the support of the government, businesses would use Blockchain Technology. However, businesses show little interest in applying these technical breakthroughs if the government is not supporting them.

“Blockchain may enable new business models to ease up the process. However, gathering this data and market insight is easy, absorbing the analyzed information into the system is challenging. Difficult to make quick shifts Blockchain ledgers create an end-to-end transparent picture” (ID 04).

“Recently, our organization adopted Blockchain Technology, and the problem was supplying the system with raw data. Since each demand is recorded separately, it has been difficult to compute the market demand from the data and feed it into the system; nevertheless, the Research and Development Department is now working to develop a solution” (ID 02).

Accordingly, feeding raw data to the system of Blockchain is a challenging task as the individual demand should be converted into market demand in order to feed the system. Table 1 analyzes the similarities and contradictions on opportunities in Blockchain Technology.

1: Similarities and Contradictions on Opportunities in Blockchain Technology

Interviewees' Opinions	Similarities	Contradictions
Blockchain Technology creates new business models	Blockchain technology helps firms to develop new business models, according to IDs 01 and 4.	According to ID 01, giving information at their end users' fingers was simple. ID 04, however, said that their company was experiencing trouble getting individual data into the system.
Blockchain Technology creates leading solutions for customers	ID 01 and ID 04 agreed with Blockchain Technology creating solutions for customer problems.	ID 03 somewhat agrees with the opinions gave by ID 01 and ID 04; however, it was ID 04 opinion that Blockchain Technology's main purpose is to ease up the business activities.
Blockchain Technology generate solutions that are hard to imitate	Blockchain technology, according to ID 01, an IT sector professional, is difficult to replicate. ID 02 shared this opinion.	None
Blockchain Technology allows organizations to decreased costs through interconnection	When it comes to reducing costs, IDs 02 and 06 concurred long-term cost reductions, as opposed to short-term ones, can be seen, according to ID-06, nevertheless.	Since ID 07 is currently being implemented, no cost savings have yet been noticed. Additionally, ID-06 said that while it may be difficult to track short-term cost reductions, long-term cost reductions will undoubtedly occur.
Blockchain Technology allows organization to increased quality and traceability	End-to-end encryption, according to IDs 01, 02, and 03, has been used in the shipping and terminal industries as well as the fast-moving consumer goods (FMCG) sector to secure and track customer data.	None
Blockchain Technology decreased documentation and administration in an organization	According to ID 07, there has been a slight reduction in documentation.	According to ID 05, the amount of reduction of documents required varies depending on the industry. As for ID 05 's company reduction of documents is a hard process.
Blockchain Technology allows increased speed and reactive capabilities	IDs 02 and 03 claimed that the company was able to accelerate the manufacturing and distribution process thanks to the implementation of Blockchain Technology in IDs 02 and 03, respectively.	None

Source: Survey Data (2022)

Table 2 Table 1 analyzes the similarities and contradictions on challenges in Blockchain Technology.

Table 2: Similarities and Contradictions on Challenges in Blockchain Technology

<b>Interviewees' Opinions</b>	<b>Similarities</b>	<b>Contradictions</b>
Blockchain Technology makes organizations replaceable due to standardization	ID 01 and ID 06 claims that Blockchain Technology have replaced the traditional processes due to standardization.	None
Blockchain Technology makes organizations lose value creation of direct customer contact	ID 05 and ID 03 have stated that by implementing Blockchain Technology organizations have lose value creation of direct customers.	ID 04 claims that companies should focus on competing with the global market and giving more to the society, rather than focusing on creating values and emotions.
Blockchain Technology makes organizations lose organization's flexibility, requiring costly solutions	ID 02 and ID 07 have shared the same opinion about losing the organization's flexibility and requiring costly solutions for customers who are not familiar with the concept of Blockchain Technology.	ID 06 have stated that with implementing new solutions the company will have to take different paths.
Blockchain Technology lacks investments	ID 01 and ID 04 have shared the same opinion when it comes to investment to implement Blockchain Technology.	None
For the organization implementing Blockchain Technology is not reasonable	ID 07 and ID 06 both estimates that with government interest it would be easy for companies to trust the process of implementing Blockchain technology or any other technology advancements.	None
Customer demands are too individualized to implement Blockchain Technology	ID 04 and ID 02 both agreed with the opinion on individualized data, as both the companies having a hard time computing the individual demand into market demand.	None
Organizations have too little standardization to implement Blockchain Technology	Both ID 07 and ID 06 asserted that because there is not enough standards for the implementation of Blockchain, businesses will be hesitant to do so.	None
For the organizations the costs exceed the benefits of Blockchain Technology	ID 01 claims that the cost may vary from industry to industry and for ID 01 it is all about their customers' customers satisfaction.	None

Source: Survey Data (2022)

## V. CONCLUSION

According to the comparison of the results in Table 1 and Table 2, it is shown that there are less contradictions to the opinions discussed on challenges than the contradictions on opportunities. Through Blockchain based innovations that cut out the middleman, transactions will go more quickly and securely prior to the invention of cryptography. Since Blockchain Technology is still in its infant stage in Sri Lanka, the researchers determine that after seven interviews, what potential role of Blockchain Technology innovation and development the output might have on logistics and supply chain operations. As per the overall idea, it interprets that Blockchain Technology implementation in logistics and supply chain operations has its fair share of both opportunities and challenges. However, as per the present situation in Sri Lanka, the study highlights that implementation will face many challenges opposed to the opinion on its opportunities. Researchers assume this research offers helpful insights for policymakers and decision makers when obtaining initial data on a developing topic like Blockchain Technology.

Overall, researchers think this research might cater as a helpful tool for many practitioners who work in innovations and for stakeholders in different companies to examine potential future circumstances in a more rigorous and rational manner. On the one hand, business management may utilize these predictions as a springboard for implementing Blockchain Technology into its operations

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# A Quantity Estimated Method to Measure Flow of Nodes in a Freight Transport Network

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**Abstract** - This study focuses on estimating flows of nodes in a courier transportation network. Literature has quantified exiting flow of nodes by analyzing real data for quantities transported and travel time. Due to difficulties in accessing real data, a method for estimating data especially on quantity transported among nodes is required. The purpose of this study is to develop a quantity estimated method for measuring the exiting flows of nodes in a freight transport network. The level of significance of each node in the network is estimated through a proposed 'criticality factor'. Nodes are equally categorized as high, medium, and low based on the descending order of the criticality factor. A weighting scale is developed for these three categories. Google map is used to derive travel time. The exiting flow of nodes is derived as the ratio between quantity exited and the time taken. This method is applied to peak, off peak, highway, and expressway operations. The study recommends using proper amount of equipment at nodes, consolidation of vehicles and relocation of warehouses. This study contributes to the domain of cost reduction in freight network by estimating the exiting flows of all the nodes in a freight network.

**Keywords:** *Exiting Flow, Freight Network Flow, Criticality Factor, Quantity Estimated, Maximum Vehicle Capacity*

## I. INTRODUCTION

Monitoring network statistics is crucial for lowering the total operation cost, especially for courier service providers in the freight transportation industry. Estimating the exiting freight flow of each node in a courier transport network is vital for identifying strategies to lower the total operation cost of the network. Statistical information on quantity of freight transported between nodes and time taken for freight movement between those nodes are required to estimate the freight flow of each node in the network. However, these statistical information on exiting freight quantity and time taken are not properly maintained by the courier service providers due to many reasons such as high freight volume, high speed data, requisition of advanced hardware for collection of data etc. This situation leads to no or improper estimation of freight flow of nodes in the network. Simulation methods have been developed in the existing literature to estimate

exiting freight flow of nodes using partially collected statistical information on vehicle capacity, freight quantity, frequency of vehicles, speed of vehicle, travel time etc. No method has been developed to estimate the exiting freight flow of nodes in a network where only the information on maximum capacity of vehicles is available. Lack of proper methods to estimate the freight flow of nodes in transport network when the information only on the vehicle capacity is available leads to improper location of nodes (warehouses), improper vehicle routing, unnecessary allocation of material handling equipment and staff at nodes (warehouses). All these result in increased total operation cost of freight transport network. Increased total operation costs affect both the courier service provider and the customer. Therefore, the objective of this study is to develop a quantity estimated method to estimate the exiting freight flow of nodes in a transport network and the sub objective is to examine how the flow of traffic varies based on both the time of day and the type of the route.

## II. LITERATURE REVIEW

In order to compute the exiting flow of each node in the freight transport network, it is necessary to know the quantity of freight transported from each node to all the other nodes and the time taken for those movements of freight among nodes.

### A. Measuring the Travel Time for Goods Movement Among Nodes

Several approaches for measuring travel time for goods movement/ traffic among nodes or in routes in the transport network have been proposed in previous studies. One of them is the vehicle sensing method. This approach employs 5-minute traffic volume and dwell periods acquired from vehicle sensors, as well as vehicle length, to determine the speed of cars directly beneath the sensors. The travel time for that road segment is determined using the predicted speeds and lengths of the road section (Sano et al., 2000). However, this strategy can only be employed if a specific density of car sensors is deployed.

Another approach for calculating travel time is the Automated Vehicle Identifier method (AVI). In this approach, upstream and downstream data from car plates saved with AVI are considered, and the downstream (arriving vehicle) end is compared to the upstream end (departing vehicle). The journey time is computed by subtracting the departure and arrival times. When the vehicle count reaches the given limit for a defined time (5 minutes), the vehicle travel times are averaged, and the AVI measured travel time is determined. In this manner, travel time may be directly determined using the AVI method (Van Der Zijpp, 1997). However, there are several issues with the approach, such as the fact that it does not provide a good interpretation when a vehicle takes a path other than the predicted one, when the measuring section is long, and when there are significant changes in traffic conditions.

The most trustworthy location and movement trajectory data have been found to be incorporated by major mobile operating system developers such as Google Android and Apple iOS. Google map data advantages include potentially comprehensive geographical and temporal coverage, high positioning accuracy, low maintenance costs, and the ability to monitor travel time when weather and traffic conditions change (Dumbliauskas et al., 2017).

### B. Measuring Quantity Transported

Existing research used genuine data from its original sources to calculate the amount of quantity transported (Purboyo & Ibad, 2017). Aside from that, other technologies for measuring precise amounts, such as Radio Frequency Identification Devices (RFID) and Global Positioning System (GPS), may be recognized. RFIDs are inexpensive tags that aid in the tracking of products and vehicles. These devices are attached to particular products and can be either active (constantly sending a radio frequency signal) or passive (only emitting a signal when queried by an outside source (Ollivier 2005)).

GPS tracking uses satellites to monitor fleets of vehicles or cargo containers, ensuring that there are no unscheduled pauses and that a preplanned path is followed. The primary disadvantages of the methodologies are the data requirements and the computational complexity of the solution procedure. Aside from that, each sector's cost function necessitates a massive quantity of data, which is frequently confidential and not published owing to its possible strategic influence (Ollivier, 2005). Estimating freight flow is crucial when genuine data is limited, enabling informed decisions in transportation planning and logistics optimization despite constraints.

### C. Criticality of Nodes

Criticality is vital for assigning a certain weight factor to a node, which finally reflects the trip attractiveness of that particular node. When measuring exiting flow of nodes, it is discovered that evaluating the criticality of each node in a network is necessary since it provides accurate interpretations of the degree of flow in a specific node. When measuring criticality, node degree and betweenness centrality in the transport network have been used. Past research has measured the criticality of a network using functionality and operational characteristics of each node (Xie, F., & Levinson, D.,2011). Functionality and operational characteristics are highly propositional to a particular node's criticality (Psaltoglou & Calle, 2018).

## III. METHODOLOGY

This methodology estimates freight flow and quantity transported between nodes using a nine-step approach based on known vehicle capacity. It improves transportation planning, logistics management, and supply chain efficiency.

Consider a network that consists of  $n$  nodes where  $n_A$  denotes the central hub. ( $n$  includes  $n_A$  as well). In this case study, a trip between any nodes occurs from the particular origin node to destination node through a Central node.

Step 01- Travel time from central node ( $n_A$ ) to all the other nodes ( $n_1, n_2, n_3 \dots n_{(n-1)}$ ) in the network is found. Then the travel time from all the other nodes ( $n_1, n_2, n_3 \dots n_{(n-1)}$ ) to the central node ( $n_A$ ) is found.

Step 02- Travel time between any pair of nodes (except central node)  $n_i$  to  $n_j$  is calculated by taking the summation of travel time ( $T_{n_i, n_j}$ ) from  $n_i$  to  $n_k$  ( $T_{n_i, n_k}$ ) and  $n_k$  to  $n_j$  ( $T_{n_k, n_j}$ ).

$$T_{n_i, n_j} = T_{n_i, n_k} + T_{n_k, n_j} \quad (1)$$

If any movement from  $n_i$  to  $n_j$  is passing a traffic zone, in addition to the normal time, time taken to pass that traffic zone is calculated by the ratio of distance and the traffic jam speed. To calculate traffic jam speed, measure the distance between two points and record the time it takes for a vehicle to travel that distance. Divide the distance by the time to obtain the average speed.

Step 03- The distance from any node to the nearest larger trip attractor is found. This distance is denoted as  $x_i$ .

Step 04- The criticality factor for each node is found as shown below.

$$C_i = \left\{ 1 - \left[ \frac{x_i - x_{(least)}}{x_{(highest)} - x_{(least)}} \right] \right\} \times 100\% \quad (2)$$

$C_i$  = criticality factor for node  $i$  in terms of percentage  
 $x_{(highest)}$  = maximum  $x_i$  out of all observed  
 $x_{(least)}$  = minimum  $x_i$  out of all observed

Step 05- This 'c<sub>i</sub>' value is multiplied by the maximum capacity in kilograms of the truck ( $V$ ) to find the quantity of goods transported ( $q$ ) from central node to other nodes.

Step 06- The criticality factor for all nodes is ordered from highest to lowest. Nodes are categorized based on the criticality factors. Each category consists of approximately equal number of nodes.

Step 07- Weights for each category is found by the following formula.

$$w_k = \left[ \frac{q(k)}{q(all)} \right] \times 100\% \quad (3)$$

$w_k$  = weight of the  $k^{th}$  node category  
 $q(k)$  = total quantity of goods received by all the nodes in  $k^{th}$  category from the central hub  
 $q(all)$  = total quantity of goods received by all nodes in the network (include the central node) from the central hub  
 $n$  = number of nodes in the network

Step 08- The amount of quantity transported between any node  $n_i$  and  $n_j$  ( $q_{(n_i-n_j)}$ ), is calculated by the following equation.

$$q_{(n_i-n_j)} = \frac{C_{(n_i)\%} \times C_{(n_j)\%} \times V}{N_i \times N_j} \quad (4)$$

$V$  - maximum capacity of the truck in kilograms  
 $C_{(n_i)}$  - Criticality percentage of origin node  
 $C_{(n_j)}$  - Criticality percentage of destination node  
 $N_i$  - number of nodes in the node category that include node  $n_i$   
 $N_j$  - number of nodes in the node category that include node  $n_j$

Step 09- The Quantity Estimated Existing Flow (QEEF) for each node is calculated as follows.

$$QEEF_k = \frac{\sum_{i=1}^n (a \times q_{n_k n_i})}{\left( \sum_{l=1}^n (a \times t_{n_k n_l}) \right) n} \quad (5)$$

$QEEF_k$  = flow of node  $k$   
 $a$  = existence of a link (either 1 or 0)  
 $q_{n_k n_i}$  = amount of quantity transported from  $n_k$  to  $n_i$   
 $t_{n_k n_i}$  = time taken to travel from node  $n_k$  to any node  $n_i$   
 $n$  = number of nodes in the network

## IV. DATA PRESENTATION AND ANALYZING

### A. Introduction

A courier firm was selected to demonstrate the method of estimating the network flow. The central node of the network is Colombo, and the other 27 nodes of the network are Colombo (1), Biyagama (2), Katunayake (3), Yakkala (4), Awissawella (5), Kaluthara (6), Horana (7), Kurunegala (8), Kandy (9), Galle (10), Mathara (11), Dambulla (12), Nuwaraeliya (13), Kegalle (14), Rathnapura (15), Hambanthota (16), Polonnaruwa (17), Anuradhapura (18), Ampara (19), Batticaloa (20), Mahiyanganaya (21), Maravila (22), Balangoda (23), Embilipitiya (24), Bandarawela (25), Trincomalee (26), Jaffna (27) and Vavuniya (28). The goods collected at each node are sent to central node (Colombo). A vehicle for each node is allocated to transport the goods to Colombo. Then the goods are delivered to the destination nodes from Colombo during off peak hours (probably at midnight). The proposed steps to estimate the network flow are demonstrated.

Step 01- First, travel time from Colombo to all the other 27 nodes was found using google maps. Then this method was applied to find the travel time from all the other nodes (except Colombo) to Colombo as well.

Table 1. Travel time matrix in hrs. (without using expressway – peak time)

	1	2	3	...	28
1	0.00	1.14	1.89	...	5.28
2	0.73	0.00	2.62	...	6.02
3	0.72	1.85	0.00	...	6.00
...	...	...	...	...	...
28	5.33	6.47	7.22	...	0.00

Source: Survey Data (2023)

Step 02 - Travel time between any pair of nodes (except Colombo) was calculated as follows.

As an example, the travel time from Biyagama (2) to Katunayake (3) (TBK) was calculated by taking the summation of travel time from Biyagama to Colombo (1) (TBC) and Colombo to Katunayake (TCK).

$$T_{n_2,3} = T_{n_2,n_1} + T_{n_1,n_3} \quad (6)$$

$$TBK = TBC + TCK$$

$$= 0.73 \text{ h} + 1.89 \text{ h}$$

$$= 2.62 \text{ h}$$

Step 03 - All the network's traffic zones were taken into account, and when a vehicle passed through a traffic zone, time taken to pass that traffic zone is calculated by the ratio of distance and the traffic jam speed. When determining the travel time between Biyagama and



Katunayake, for example, the Colombo traffic zone must be taken into account. Traffic zones can be identified from google maps by selecting “traffic” from the menu button. On the map, there are four colored lines which are green, orange, yellow and red. Routes having green lines show that traffic is moving quickly, while those with red lines suggest that traffic is moving slowly. As a result, the distance of the Colombo traffic zone (13.7 km) must be divided by the speed at jam density in Colombo which is 17 kmh-1 (Sandaruwan et al., 2019).

Step 04 - To measure the criticality of each node, the distance from each node to the nearest trip attractor was taken into account. Export Processing Zones were considered as the nearest trip attractors. They were Mawathagama, Polgahawela, Mirigama, Katunayake, Biyagama, Colombo, Horana, Seethawaka, Koggala, Kandy, Malwatta, Wathupitiwela and Mirijjawela.

Table 2. Distance to the nearest EPZ from each node

Sub Node	Nearest EPZ	Distance to the Nearest EPZ (km)
Katunayake	Biyagama	1.4
Awissawella	Seethawaka	0.8
Biyagama	Biyagama	6.0
Hambanthota	Mirijjawila	9.6
Horana	Horana	10.5
...	...	...
Jaffna	Mavathagama	305.7

Source: Survey Data (2023)

Step 05 - After finding the distance to the nearest EPZ, all the values were ordered from highest to lowest in order to measure the criticality. First 9 nodes were taken as high critical nodes, next 9 nodes were taken as medium critical nodes and last 10 nodes were taken as least critical nodes. (Even though Colombo was taken as a medium critical node, an assumption was made that Colombo should be considered as a high critical node because it is the central hub of this network).

Step 06- Using the below formula, the percentage of criticality of all 28 nodes were calculated. As an example, when considering Biyagama node,

$$C_B = \left\{ 1 - \left[ \frac{x_B - x_{(least)}}{x_{(highest)} - x_{(least)}} \right] \right\} \times 100\% \quad (7)$$

$$C_B = \left\{ 1 - \left[ \frac{6km - 1km}{306km - 1km} \right] \right\} \times 100\%$$

$$C_B = 98.3607\%$$

Table 3. Percentage of quantity transported for each node from the central hub

Sub Node	% Of Quantity Transported
Katunayake	100
Awissawella	100
Biyagama	98.3607
Hambanthota	97.0492
...	...
Jaffna	0

Source: Survey Data (2023)

Sub Node	Quantity Transported (kg)
Katunayake	4000
Awissawella	4000
Biyagama	3934.43
Hambanthota	3881.97
...	...
Jaffna	0

After finding the percentage of criticality, it should be multiplied by the maximum capacity which is 4000 kg.

Table 4. Quantity transported for each node from the central hub

Source: Survey Data (2023)

Step 07- Ratio for high critical nodes (MH) is shown below,

$$M_H = \left[ \frac{q(H)}{q(all)} \right] \times 100\% \quad (7)$$

$$M_H = \left[ \frac{38.7016}{85.6787} \right] \times 100\%$$

$$M_H = 45.1707\% \underline{\underline{45\%}}$$

(Here  $q(H)$  refers to all the quantities that are transported to high critical nodes from the central hub and  $q(all)$  refers to total quantity that is transported to all nodes from the central hub)

Ratio for medium critical nodes (MM) is shown below,

$$M_M = \left[ \frac{q(M)}{q(all)} \right] \times 100\% \quad (8)$$

$$M_M = \left[ \frac{27.8557}{85.6787} \right] \times 100\%$$

$$M_M = 32.5119\% \underline{\underline{33\%}}$$

Ratio for low critical nodes (ML) is shown below,

$$M_L = \left[ \frac{q(L)}{q(all)} \right] \times 100\% \quad (9)$$

$$M_L = \left[ \frac{19.1213}{85.6787} \right] \times 100\%$$

$$M_L = 22.3175\% \approx 22\%$$

Step 08 - The amount of quantity transported between two nodes is estimated as below. As an example, the quantity transfer between a high critical node (Biyagama) and a medium critical node (Kandy) is taken into account,

$$q_{(H-M)} = \frac{C_{B(H)\%} \times C_{K(M)\%} \times 4}{\text{Number of H X M nodes}} \quad (10)$$

$$q_{(H-M)} = \frac{45\% \times 33\% \times 4}{10 \times 8}$$

$$q_{(H-M)} = 0.007425 \text{ t}$$

$$= 0.007425 \text{ t}$$

Table 5. Quantity transported between nodes in kg  
Source: Survey Data (2023)

Step 09- The total amount of quantity transferred from that particular node to all the other nodes (27) and the sum of travel time from that node to all of the other nodes (27) were used to compute network flow for a node.

For an example, network flow for Biyagama is (12) calculated as below,

$$QEEF_B = \frac{\sum_{i=0}^n (a \times q_{n_B n_{n-1}})}{\left( \sum_{i=0}^n (a \times t_{n_B n_{n-1}}) \right) n} \quad (11)$$

$$(q_{n_B n_{n-1}} = 0.000+8.1+8.1+\dots+3.96=171.9 \text{ kg})$$

$$(t_{n_B n_{n-1}} = 0.00+1.14+1.89+\dots+5.28=122.33 \text{ h})$$

$$QEEF_B = \frac{1 \times 171.9 \text{ kg}}{(1 \times 122.33 \text{ h}) \times 1}$$

$$QETNF_B = 1.4052 \text{ kg h}^{-1}$$

Condition 02- QEEF when using expressways during peak hours

All the calculations were done according to the above methodology. Here the travel time has been reduced due to the usage of expressways.

Table 6. Travel time matrix in hrs. (using expressways - peak time)

	1	2	3	...	28
1	0.00	1.14	0.53	...	5.28
2	0.73	0.00	1.27	...	6.02
3	0.72	1.85	0.00	...	6.00
...	...	...	...	...	...
28	5.33	6.47	5.87	...	0.00

Source: Survey Data (2023)

Condition 03- QEEF when using expressways during off-peak hours

All the calculations were done according to the above methodology. Here the travel time has been reduced due to the usage of expressways and off-peak hours.

Table 7. Travel time matrix in hrs.(using expressways – off-peak time)

	1	2	3	...	28
1	0.00	0.55	0.53	...	4.82
2	0.73	0.00	1.27	...	5.55
3	0.72	1.27	0.00	...	5.53

	1	2	3	...	28
1	0.000	8.1	8.1	...	3.96
2	8.1	0.000	8.1	...	3.96
3	8.1	8.1	0.000	...	3.96
...	...	...	...	...	...
28	3.96	3.96	3.96	...	0.000

...		...	...	...	...	...
28		5.33	5.88	5.87	...	0.00

Source: Survey Data (2023)

Condition 04 - QEEF when using normal routes without expressways during off-peak hours

Table 8. Travel time matrix in hrs. (without using expressway-off-peak time)

	1	2	3	...	28
1	0.00	0.55	0.53	...	4.82
2	0.73	0.00	1.27	...	5.55
3	0.72	1.27	0.00	...	5.53
...	...	...	...	...	...
28	5.33	5.88	5.87	...	0.00

Source: Survey Data (2023)

## V. ANALYZING

After calculating the QEEF for the above mentioned four scenarios, the descending order of the QEEF values can

be listed as condition 3 (with expressways, off-peak), condition 4 (no expressways, off-peak), condition 2 (with expressways, peak time) and condition 1 (no expressways, peak time). So, the highest flow is in the third condition which is the QEEF values during off-peak time in expressways and least QEEF values are obtained in the first condition which is the QEEF values during peak time in normal routes without expressways. When ranking all 28 nodes according to the QEEF values, the order of the nodes is almost the same in all four situations. It is identified that, Colombo, Biyagama, Katunayake, Yakkala, Horana, Awissawella, Kaluthara, Galle, Maravila, Kegalle and Kurunegala have higher flow under all these conditions whereas Mathara, Rathnapura, Hambanthota, Kandy, Embilipitiya, Dambulla, Mahiyanganaya, and Balangoda have medium flow under all these conditions and Anuradhapura, Nuwaraeliya, Polonnaruwa, Bandarawela, Vavuniya, Trincomalee, Ampara, Batticaloa, and Jaffna have lower flow under all these conditions. Hence, there are slight differences in condition 2 and 4. When considering the QEEF values of condition 2 (with expressways, peak time) Biyagama has been ranked as two and Katunayake as three which is ranked vice versa in all other conditions (Biyagama ranked as three and Katunayake ranked as two). When considering the QEEF values of condition 4 (no expressways, off-peak time) Kandy has been ranked as 16 and Embilipitiya as 15 which is ranked vice versa in all other conditions (Kandy ranked as 15 and Embilipitiya ranked as 16).

Table 9. Rankings of nodes according to their flow (Rank number 01= highest flow)

City	Condition - 01	Condition - 02	Condition - 03	Condition - 04
Colombo	1	1	1	1
Biyagama	3	2	3	3
Katunayake	2	3	2	2
...	...	...	...	...
Vavuniya	24	24	24	24

Source: Survey Data (2023)

## VI. DISCUSSION

As stated in the study, not many studies have been done using estimated values for quantities (where real data is not available), and the findings of this newly developed study can be used to measure freight network flow when data is unavailable. Aside from that, the developed index values can be used to improve freight network flow in low-flow areas.

According to the QEEF values, certain nodes have less flow than others. As a result, the warehouses in less flow areas (Vavuniya – 0.8489 kg/h/Jaffna – 0.2940 kg/h) can be relocated, which lowering the organization's total expenditures. Because maintaining an extra warehouse is expensive, this strategy can be utilized for sub nodes with less flow. Because of the high revenues, it is suggested that instead of maintaining a warehouse for regions with low flow, a 3PL service can be adopted.

A consolidated vehicle can be used to transport goods from nodes whose summated flows are equal or less than equal to the vehicle capacity. When the total weight exceeds 4000 kg, a larger capacity vehicle might be employed to transport the products. This will assist in boosting the flow of the courier service network by transporting more products in a shorter period of time.

More equipment can be used at high flow nodes (Biyagama – 1.4052 kg/h/Katunayake – 1.4191 kg/h) to boost the flow of goods, whereas fewer linked nodes can use less equipment because their flow is lower. Nodes with less flow (Trincomalee – 0.3461 kg/h, Bandarawela – 0.3666 kg/h) can be boosted by lowering trip time by delivering items during off-peak hours, which avoids traffic congestion. To travel during off-peak hours, warehouse processing time should be reduced by deploying more equipment that requires less labor. As a result, using an automated system in warehouses can improve network flow.

The best route with ideal conditions should be utilized to optimize the profit factor. It has been observed that not using expressways during peak hours greatly lowers flow, but that some specific scenarios reduce/enhance the flow of certain nodes. As a result, taking expressways during peak and off-peak hours is both cost economical and time efficient. It is also suggested that dispersing the whole amount during off-peak hours reduces costs due to reduced congestion. While the QEEF data are examined, it is usually revealed that nodes have high flow (Galle – 1.0876 kg/h/Yakkala – 1.39078 kg/h) when supplying commodities during off-peak hours.

In this expressway with peak hour situation, lengthening the waiting time allows for a higher flow than previously. So, when there is a full load to be carried, commodities transfer from less flow nodes (Polonnaruwa – 0.3687 kg/h /Bandarewala – 0.3666 kg/h) may be completed in two days. This method will improve the flow of the courier service network while also lowering costs.

## VI. CONCLUSION

The method used in this research study can be applied to a variety of commercial and non-commercial domains,

such as port networks, supermarket networks, and so on, to improve the freight network flow of their particular transport network and, as a consequence, to increase the profit factor as well as the efficiency and productivity.

#### D. Limitations

The main limitation of this research is the unavailability of data as this study has chosen a very competitive commercial industry. The lack of information in this study led to a lot of assumptions. It was assumed that the amount of goods transported to each node was assumed to be proportional to the criticality of that node since functionality and operational characteristics are highly propositional to a particular node's criticality (Psaltoglou & Calle, 2018). Even Colombo is a medium critical node according to the results obtained, it was assumed as a high critical node because it acts as the central hub of this network. As the next assumption, when there is a traffic zone between two nodes, extra time was added to the total time taken to travel (When calculating the travel time between Colombo and Kandy, extra time was added to the total time since there is a traffic zone in between).

#### E. Future Research

In future research, it is suggested that accessibility and mobility, as well as the population and consumer behavior of each location, be considered as key influences on the network flow of a node. Furthermore, the index's accuracy can be improved by using real values for quantities to measure the flow of goods.

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# Adaptation of Blockchain Technology in Banking Sector in Sri Lanka: Opportunities and Challenges

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**Abstract** - Blockchain Technology is one of the main components in Industry 4.0 implications which enable organizations to trace transactions, create new business models to solve customer problems, increase the quality and productivity, etc. Blockchain technology is used in various industries such as supply chain industry, banking industry, healthcare industry, construction industry and many more. However, in Sri Lanka there is a gap while implementing blockchain technology in banking sector despite the number of on-going and completed projects. The primary goal of this study was to identify the challenges and opportunities in blockchain adaptation and identify how the banking sector should be facilitated in the future to implement blockchain based banking systems. Cluster sampling and intensity sampling techniques were used to identify the sample. In-depth interviews were used for data collection, and they were analyzed using Thematic Analysis. Technological, Organizational and Environmental (TOE) framework was used in developing the questionnaire and to support the data analysis. The study shows that implementing blockchain-based banking systems would improve the transactions' transparency, give managers access to real-time data, improve the transactions' auditability, and save consumers time and effort. Additionally, the key reasons that challenge the implementation of blockchain technology were lack of technological understanding and accessibility, organizational hurdles, and environmental barriers.

**Keywords:** *Blockchain Technology, Banking, Thematic Analysis*

## I. INTRODUCTION

Since then, the growth of online businesses, the Internet of things (IoT), and mobile computing have changed consumer purchasing habits and corporate processes. Thanks to the internet, customers can communicate directly with product distributors. By eliminating some middlemen, the supply chain has been shortened, and cooperation has increased as a result. A few businesses have already begun integrating blockchain technology into their business processes, even though it is still challenging for an organization to accept new technologies, as it represents a substantial technological advancement and

disruptor lacking the necessary preparation for the digital transformation (Abeysekera & Kumarawadu, 2022; Elvers & hoon Song, 2014; Stank et al., 2011).

In contrast to traditional centralized financial ledger systems, which provide a bank complete control over transactions recorded into the ledger, a decentralized and distributed ledger, like blockchain, has no central authority and enables each node of the network to retain an exact copy of the ledger. Furthermore, the use of blockchains enables automated, simplified, and efficient processes while maintaining security through difficult validation processes. In many industrialized nations during the past ten years, blockchain-based business solutions have experienced enormous growth. For the start of blockchain adoption, the banking, finance, insurance, healthcare, and supply chain industries have built the regulatory framework and technological foundation (Liu et al., 2019; Wang & Kogan, 2018). They enable a group of users to log transactions in a shared ledger at the most fundamental level so that, assuming the blockchain network is operating smoothly, no transaction can be amended once it has been recorded.

The banking industry in Sri Lanka is currently facing multiple several challenges, including a decrease in revenues and a rise in risk, and has entered a new phase of growth and transformation. The sudden Internet finance development has also caused several issues in the traditional banking sector. Therefore, commercial banks must rely on cutting edge technology. New client needs and competitive markets are made possible by technological developments that hasten the improvement of products and services. Blockchain technology could significantly reduce the cost of financial services while improving product quality. Financial institutions are using this technology to find solutions to the problems of speed and cost today. Some tasks can be automated when using blockchain. A secure, open, and user-friendly decentralized database is the blockchain. These capabilities make it possible to automate a variety of banking-related procedures (for example, payments or issuing loans).

Table 1: Blockchain based Projects in Sri Lankan Banking Sector

Name of the Bank	Project	Duration
Central Bank	Know Your Customer (KYC) project	More than two years
Sampath Bank	igift Project	3 years
HSBC	Digital Vault	5 years
NDB Bank	TradeLens	More than 5 years

Source: Survey Data (2022)

According to the Table 1, there have been projects on the blockchain implementation in the banking sector, amongst which Central Bank's KYC project is a well-known project in Sri Lanka. However, most of the projects are still in their implementing stage. Some of them had issues and some of them gained advantages. In this study, the researchers' main objective was to identify the main challenges and opportunities and attempt to add new knowledge and awareness for the future researchers and decision makers in the banking sector in Sri Lanka.

## II. METHODOLOGY

According to the research philosophy interpretivism was used since it explored from a scientific and qualitative standpoint. The researchers followed an inductive approach since it has examined the subject area using qualitative techniques. When it comes to research strategies, the researchers have used interview method to collect data. The researchers have adopted a mono method approach and cross sectional as the time horizon.

As this research is about blockchain technology of banking sector in Sri Lanka, the sample population was all private and public banks in Sri Lanka. The sample size was selected using cluster sampling technique on the criteria of banks that have previously conducted and currently conducting new projects on blockchain based systems which have been published in all media (newspapers, articles, research and publications). Accordingly, the researchers identified four banks in Western Province in Sri Lanka by referring the media and selected eight interviewees using intensity sampling technique on the

basis of practitioners and professionals who have been involved in blockchain adaptation projects and those who have been researching about them. Similarly, cluster sampling (Thomas, 2022) and intensity sampling (Patton, 2001) techniques were used to identify the most relevant information rich professionals and practitioners to answer the research questions.

Accordingly, the respondents were given ID as Managing Director (I1), Manager – Data Science and Solutions (I2), Senior Lecturer Gr. I (I3), CEO (I4), Manager – Digital Implementation (I5), Manager – Global Remittances (I6), Director – Credit Section (I7) and Manager – Research and Development (I8). Data collection was conducted through e-mailed questionnaires and interviews via Zoom which last between 35 and 60 minutes. Data analysis was conducted following the Braun and Clarke (2006) Thematic Analysis. The Technological, Organizational and Environmental (TOE) framework was used to develop the questionnaire which is widely used in research related to adoption of blockchain in various businesses (Clohessy & Acton, 2019; Clohessy et al., 2019; Dai & Vasarhelyi, 2017). Secondary data was collected from journal articles, magazines, newspapers, and reports.

## III. RESULTS AND DISCUSSIONS

According to this research data collected through face-to-face structured interviews with top level managers and one middle level managers and directors in banking industry. Following the completion of the data collection process, all interviews were transcribed into word documents. The transcripts were meticulously examined one by one to identify the codes in each interview. After identifying all the codes in each interview, the codes were entered into a table with all the codes in separate columns. The remaining codes were entered into a word document after duplicates and codes with similar meaning were removed.

All the interviewees were asked three main structured questions on (1) lack of adoption of blockchain technology in Sri Lanka, (2) benefits and challenges of blockchain adoption in banking sector and (3) facilitating blockchain adoption for banking sector in the future. The initial coding generated is depicted in Table 2.



Table 2: Initial Coding based on TOE Framework

Interviewee	Highlighted Response	Initial Coding
I4, I3, I5	<ul style="list-style-type: none"> <li>The technique is sufficiently developed. The infrastructure is the issue. However, because the processes are not user-friendly, it is challenging to reach the public and meet user needs.</li> <li>Technological infrastructure is very important when it comes to blockchain adoption.</li> <li>There is no national cloud here. We do have a government cloud, but not everyone has access to it.</li> </ul>	Technological
I6, I8, I2, I1	<ul style="list-style-type: none"> <li>Insufficient investment.</li> <li>Cost-benefit analysis, project's value, financial returns, and the level of confidence (trust).</li> <li>Project transactions typically have enormous values and come with hefty interest rates and premium charges.</li> <li>Assist to manage cash flow activities, reduce non-payments, and payment issues in the supply chain.</li> </ul>	Organizational
I4, I7	<ul style="list-style-type: none"> <li>Support of numerous stakeholders' interest and their trust.</li> <li>Different stakeholder groups should join and be on par for a blockchain implementation. Additionally, numerous counterparties must be open to using a blockchain for it to make sense.</li> <li>Lack of awareness and information</li> </ul>	Environmental

Source: Survey Data (2022)

As per Table 1, researchers identified twelve main themes from initial three codes. There are defined as follows.

- i. User-friendliness as a Technological Factor in Blockchain Implementation
- ii. Payment Facilities as a Technological Factor in Blockchain Implementation
- iii. Lack of Infrastructure as a Technological Factor in Blockchain Implementation
- iv. National Cloud as a Technological Factor in Blockchain Implementation
- v. High Initial Cost as an organizational Factor in blockchain implementation
- vi. High Maintenance Cost as an organizational Factor in blockchain implementation
- vii. Process Optimization as an organizational Factor in blockchain implementation
- viii. Financial Benefits as an Organizational Factor in Blockchain Implementation
- ix. Common Platform as an Environmental Factor in Blockchain Implementation
- x. Ownership and Control as an Environmental Factor in Blockchain Implementation
- xi. Lack of Trust as an Environmental Factor in Blockchain Implementation
- xii. Stakeholder Interest as an Environmental Factor in Blockchain Implementation

Accordingly, interpretation of opportunities and challenges are depicted in Table 3 as follows.

Table 3: Interpretation of Opportunities and Challenges

Opportunities	Challenges
<ul style="list-style-type: none"> <li>User-friendliness</li> <li>National Cloud</li> <li>Financial Benefits</li> <li>Stakeholder Interest</li> <li>Process Optimization</li> <li>Common Platform</li> </ul>	<ul style="list-style-type: none"> <li>Payment Facilities</li> <li>Lack of Trust</li> <li>Lack of Infrastructure</li> <li>High Initial Cost</li> <li>High Maintenance Cost</li> <li>Ownership and Control</li> </ul>

Source: Survey Data (2022)

#### IV. CONCLUSION

Sri Lankan banking sector has not adopted blockchain technology due to three main reasons: lack of technological understanding, organizational hurdles, and environmental barriers. To promote blockchain, the government should establish necessary technological infrastructures, build environmental variables like sponsorship and inter-organizational trust, and resolve control-related problems. Implementing blockchain-based banking ecosystems would improve transaction transparency, provide real-time data access, enhance auditability, and save time and effort. However, traditional accountants and managers may face difficulties adjusting to blockchain technology, potential cyber-attack vulnerabilities, system faults, disruptions, and increased fees. To facilitate adoption, regulatory bodies should connect current ERP systems with blockchain ecosystems, introduce system ethics for professional accountants, managers, and IT specialists, and establish bank-level integrations between IT specialists and professional managers. A thorough understanding on challenges and opportunities helps the decision makers prior to investing

on blockchain related projects. It also gives professionals in the banking industry, an understanding of how their field might be impacted in the future by the adoption of blockchain based banking systems and what must be facilitated. According to the objectives of the study, twelve factors were identified with six factors each for opportunities and challenges.

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# Influence on E-Service Quality of E-Tailors on E-Satisfaction and E-Repurchase Intention on Consumer Electronics Purchase Behavior: Examining the Moderate Impact of E-Word-of-Mouth in Sri Lanka

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**Abstract** - The main goal of this study is to investigate the effects of e-service quality provided by e-tailors on consumer electronics on e-repurchase intention in Sri Lanka, with e-customer satisfaction acting as a mediator and e-word-of-mouth as a moderator. The E-S-Qual and E-RecS-Qual models were employed in the research study to evaluate the quality of e-services. The seven factors are efficiency, fulfillment, system availability, privacy, compensation, responsiveness, and contact. A self-administered questionnaire that garnered a total of 300 valid responses out of 384 was utilized to collect data for an empirical study employing purposeful sampling. The data are examined using structural equation modeling with Smart PLS 4.0 and SPSS 23.0 to look at the model and test the hypothesis. The findings show that three e-service quality factors efficiency, fulfillment, and responsiveness have statistically significant influence on e-repurchase intention. On the other hand, the results demonstrated that e-service quality is related to e-repurchase intentions both directly and through the mediator of customer satisfaction. The findings have important implications for marketers and academics. The results of this study suggest that e-customer satisfaction plays a partly mediation function between e-service quality and e-repurchase intention. However, there is no moderating relationship between e-repurchase intention and e-customer satisfaction. E-tailors should put efficiency, fulfillment, and response as their top priorities. The e-tailer must interact with the customer, fulfill orders, and resolve problems.

**Keywords** - E-Service Quality, E-satisfaction, E-Repurchase Intention, E-Word-of-Mouth

## I. INTRODUCTION

Early academic research on service quality (Grönroos, 1982; Lehtinen & Lehtinen, 1982; (Grönroos, 1982; Lehtinen & Lehtinen, 1982) was based on a comparison of the company's actual service outcome and what users thought of the company's offer. According to Malhotra et al (2005), the term "eService quality" is used in a broad sense to describe all aspects of a customer's interactions with a website, including the extent to which a website facilitates ordering, shopping, and delivery efficiently and effectively. According to research on the interactions between people and technology (Malhotra, et al., 2005),

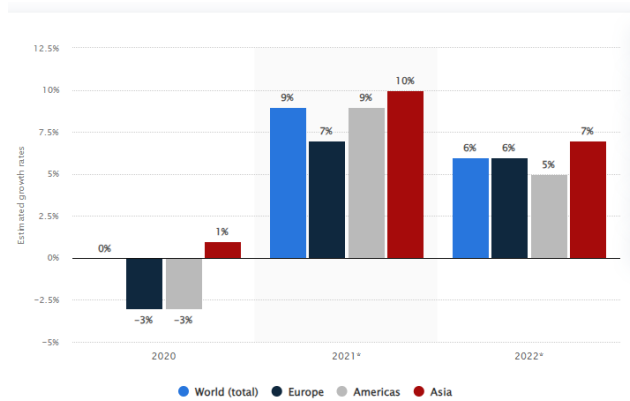
there is a special process that is defined by customer evaluation of innovation technology.

The E-S-QUAL scale and the E-RecS-QUAL scale were created by Malhotra et al. in 2005. Since it enables the measurement of both pre- and post-e-service quality factors. E-S-QUAL is a tool designed to gauge the actual experience of online shopping. Parasuraman et al (2005) have developed a companion scale known as E-RecSQUAL with the aim of capturing the effects of problems encountered during an online transaction on consumers' views of the quality of e-services. The three components of E-RecS-QUAL are responsiveness, compensation, and contact. This scale, which is utilized by both E-S-QUAL and E-RecSQUAL to measure overall rating of service quality in online shopping, was a component of the research presented in this paper.

The research study's mediator is e-satisfaction. According to Anderson and Srinivasan (2003), e-satisfaction is "the customer's satisfaction with respect to his or her prior purchasing experience with a certain e-commerce firm." In-depth analysis of the positive relationship between e-service quality and e-satisfaction may be found in past studies on the topic (Loiacono, et al., 2002; Zeithaml, et al., 2002; Zhang & Prybutok, 2005). Consumer post-purchase intention to repurchase a product or use a service is impacted by satisfaction, claim Yen and Lu (2008). Repurchase intention is defined as the intention to make additional purchases, according to Mittal and Kamakura (2001), whereas word-of-mouth is described as the intention to spread positive information about a company's products or services to another individual (Hutter, et al., 2013). Word-of-mouth (WOM) is an informal way for customers to share opinions and information about goods and services (Anderson, 1998; Arndt, 1967). In the meanwhile, researchers are exploring the moderating role of online word-of-mouth and the effects of e-service quality, e-satisfaction, and e-repurchase intention on consumer electronics buying behavior.

In a variety of industries, including healthcare, aviation, fashion, and online shopping, the majority of research studies have highlighted the influence of e-service quality and e-satisfaction on future purchase intentions (Mittal &

Kamakura, 2001; Yen & Lu, 2008; Saleem, et al., 2017). Since many of these studies focussed on the internet retail business without focusing on any specific industry, the consumer electronics industry is the focus of this research study. As measured by internet platforms, Sri Lanka's consumer electronics sector has grown at the slowest rate in recent years and global context is also there has



degrowth rate from 2020 to 2022.

Figure 5: Global Electronic Industry from 2020-2022  
Source: Statista (2022)

Figure 1 shows that from 2019 to 2021, there was growth in the global context, but that growth abruptly stopped in 2022. As a result of the Asian market, the researcher makes an effort to identify the key e-tailor service quality factors and their effects on consumer electronics e-repurchase intention and e-satisfaction. These powerful policies encourage e-tailor adoption so that they can profit both financially and otherwise. These e-Commerce startups have been constructing an economic strength in Sri Lanka over the past few years. Kapruka.com, Daraz.lk, Takas.lk, ikman.lk, Wow.lk, Wasi.lk, Zigzag.lk, Mystore.lk, Retailgenius.com, and Mydeal.lk are the top 10 e-commerce websites in Sri Lanka with the fastest growth (Prime1, 2019).

### A. Research Objectives

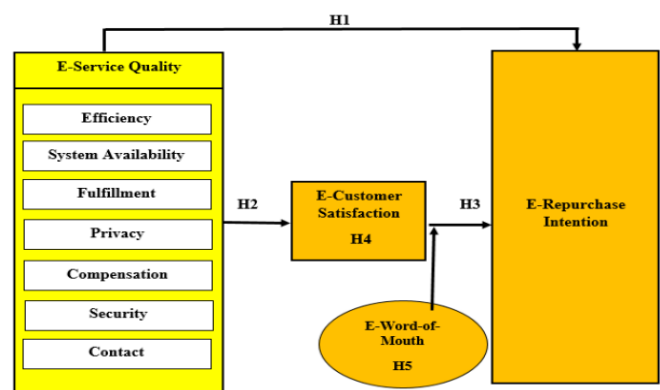
Due to a shortage of comprehensive empirical studies on the level of quality of e-services in Sri Lanka. The researcher therefore set out to identify the elements of e-service quality that were more accurate predictors of Sri Lankan consumers of consumer electronics' tendency to make future online purchases. The findings of past research and the aforementioned arguments are the main topics of the current investigation. With the mediating effects of e-customer satisfaction and the moderating impacts of e-word-of-mouth in Sri Lanka, this study examines the e-service quality of e-tailors on consumer electronics and their impact on e-repurchase intentions. In order to establish a strategy for increasing e-tailor usage on current with the rest of the world, the researcher is also aiming to explore insights with all stakeholders. In order to

learn more about the quality of e-services and e-repurchasing intention with the mediating and moderating effects, the following specific objectives are being explored.

- To examine the relative importance of each service quality factors critically on the e-repurchase intention.
- To investigate effects of the e-service quality on the e-repurchase intention.
- To investigate effects of the e-service quality on the e-customer satisfaction.
- To investigate effects of the e-customer satisfaction on e-repurchase intention.
- To assess the mediating effects of the e-customer satisfaction on the impact of the e-service quality on e-repurchase intention of consumer electronics.
- To assess the moderating effects of e-word-of-mouth on the relationship between e-customer satisfaction and the e-repurchase intention.
- To recommend the innovative strategies for the Sri Lankan e-tailors on consumer electronics in order to increase customers repurchase intent.

## II. METHODOLOGY AND EXPERIMENTAL DESIGN

The researcher attempts to establish the relationship between exogenous variables such as e-service quality as an independent variable and endogenous variables such as e-repurchase intention, customer satisfaction as a mediating variable, and word-of-mouth as a moderating variable in order to conceptualize the study. Efficiency, fulfillment, system availability, privacy, responsiveness, compensation, security, and contact features were identified following a thorough literature research as the e-



service quality in the Sri Lankan context.

Figure 2: Conceptual Framework  
Source: Developed by author based on previous literature and theories (2022)

### A. Hypothesis Development

Based on the theoretical justification provided in the published findings, the author thus proposes the following hypothesis:

H1: There is a significant impact on e-service quality and e-repurchase intention.

H1a: There is a significant impact on efficiency and e-repurchase intention.

H1b: There is a significant impact on system availability and e-repurchase intention.

H1c: There is a significant impact on fulfillment and e-repurchase intention.

H1d: There is a significant impact on privacy and e-repurchase intention.

H1e: There is a significant impact on compensation and e-repurchase intention.

H1f: There is a significant impact on responsiveness and e-repurchase intention.

H1g: There is a significant impact on contact and e-repurchase intention.

H2: There is a significant impact on E-Service quality and E-Satisfaction.

H3: There is a significant impact on E-Satisfaction and E-Repurchase intention.

H4: There is a significant mediating effect of e-satisfaction impact on of e-service quality and erepurchase intention.

H5: There is a moderating impact of E-Word-of-mouth on the relationship between E-Satisfaction and E-Repurchase intention.

### B. Research Design

The research philosophy, according to Saunders et al (2009), outlines how knowledge is created and the kinds of knowledge that are pertinent in a particular profession. Positivism holds that knowledge can be attained by taking a close look at reality and taking note of measurable facts (Blumberg, et al., 2005). The philosophy of positivism was selected for the study's use of quantitative data, large sample sizes, and high dependability (Collis and Hussey, 2009). Quantitative observations that can be employed in statistical analysis are the focus of this study. On the other hand, the quantitative approach has been used since it has a strong academic tradition and places a lot of trust in data that depicts concepts or opinions (Amaratunga, et al., 2002). The research study decided to proceed from theory to findings using a deductive technique (Bryman & Bell, 2011). Ellitan and Sugiyanto (2022) state that surveys were utilized to gather data. Survey methods are employed in this study to collect data. In this survey approach, primary data are directly (purely) gathered from a particular area,

such as information gathered by researchers through the distribution of questionnaires, interviews, tests, etc. Direct surveying was done by handing out questionnaires to respondents. The single-cross sectional technique was selected for this study because archives are more likely to employ longitudinal data and allow researchers to evaluate how a particular phenomenon changes over time (Adams and Schvaneveldt, 1991). Primary and secondary data can be distinguished within the information gathered. The primary data are those that were gathered directly, as well as those that were extrapolated from earlier studies and used in the context of the current study (Flick, 2011). The prototype survey had reliable, precise questions that were derived from earlier literary works. Considering that the literature questionnaire was first written in English. This study gave online shoppers with experience in purchasing consumer electronics online the chance to review the questionnaire, ensure that each question was appropriate and clear, and identify any potential problems. By ensuring that the respondents understood the survey's questions, this improved the survey's content validity. Each item was rated on a five-point Likert scale from 1 for "strongly disagree" to 5 for "strongly agree." There is a list of the research constructs and survey questions. The respondents' basic personal information was the focus of the final section, which used only nominal measurement scales. Non-probability sampling is an approach to sampling that denies some population segments equal access to opportunities. Purposive sampling is a method utilized in this study that entails selecting samples from the population while taking specific considerations into account (Ellitan & Sugiyanto, 2022).

### III. RESULTS

In focusing an extreme value on the use of multivariate analysis methods, the data were cleaned. Descriptive statistics that contrast Sri Lanka to other countries were then used to describe how the chosen constructs behaved in the Sri Lankan context. PLS-CTA was used to establish if the constructs are formatively measured or reflectively measured. Once the measurement type has been determined, the structural model is next assessed after the measurement model using PLS-SEM. The proposed model investigated the hypothesized connections, taking into consideration the effects of the mediating and moderating factors. The IPMA was ultimately carried out using PLS-SEM to compare and contrast the elements impacting the e-repurchasing intention of consumer electronics in Sri Lankan competitiveness.

#### *E-Service Quality and E-Repurchase Intention*

The primary objective of the study is to assess and contrast the relative impact of each service quality on Sri Lankan consumers' desire to make additional online purchases of consumer electronics. Efficiency, system availability,

fulfillment, compensation, responsiveness, communication, and privacy were found to be the service quality attributes that have the greatest impact on e-repurchasing intention. The following H1a, H1b, H1c, H1d, H1e, H1f, and H1g variations were produced as a result.

Table 1: Summary of sub hypotheses H1

No	Relationships	Original Sample	Sample mean	Std. Deviation	T statistics	2.5%	97.5%	P Value	Results
H1a	EFF->ERPI	0.243	0.243	0.061	3.960	0.119	0.360	0.000	Accepted
H1b	SA->ERPI	-0.021	-0.021	0.051	0.405	-0.128	0.077	0.686	Rejected
H1c	FL->ERPI	0.151	0.149	0.065	2.309	0.022	0.278	0.021	Accepted
H1d	PV->ERPI	-0.074	-0.070	0.069	1.065	-0.211	0.063	0.287	Rejected
H1e	COM->ERPI	0.060	0.059	0.052	1.155	-0.035	0.170	0.248	Rejected
H1f	RES->ERPI	0.462	0.460	0.066	6.946	0.323	0.582	0.000	Accepted
H1g	CON->ERPI	0.124	0.125	0.069	1.799	-0.003	0.263	0.072	Rejected

Source: Survey (2022)

The findings shown in Table 1 show that three hypotheses were empirically supported, and four hypotheses were empirically rejected. According to the research review, there is a direct relationship between e-service quality aspects and e-repurchase intention. The findings of the association between ESQ and ERPI are supported by the prior research, which indicates that e-service quality has a significant impact on e-repurchase intentions in several countries. The likelihood of repeat purchases is favourably and considerably influenced by service quality, claim (Hamdan and Rizka, 2021). The data analysis showed that there is no connection between service quality and intention to execute additional transactions, refuting the hypothesis. The possibility of making an e-repurchase is not considerably impacted by the quality of the e-service, claim Indrianti and Verinita, (2022).

Table 2: Summary of H1

No	Relationships	Original Sample	Sample mean	Std. Deviation	2.5%	97.5%	T statistics	P Values	Results
H1	ESQ->ERPI	0.848	0.848	0.021	0.716	0.827	39.935	0.000	Supported
		Reference			No Zero Falls between	>1.96	<0.005		

Source: Survey (2022)

The findings shown in Table 2 show that hypothesis was empirically supported. The findings of the impact of ESQ on ERPI are directly related to the findings that e-service quality has a significant impact on e-repurchasing intention

in several countries (Lee and Kim, 2017; Haryono, et al., 2015).

*E-Service Quality and E-Customer Satisfaction*

Table 3: Summary of H2

No	Relationships	Original Sample	Sample mean	Std. Deviation	2.5%	97.5%	T statistics	P Value	Results
H2	ECS->ERPI	0.885	0.884	0.016	0.847	0.912	53.801	0.000	Accepted
		Reference			No zero between	>1.96	<0.005		

Source: Survey (2022)

The results shown in Table 3 demonstrate the empirical validity of that hypothesis. The literature research found that there is a direct link between e-customer satisfaction and the characteristics of e-service quality. Shin, Chung, Oh, and Lee (2013) provide evidence that platform quality is essential for raising consumer repurchase intention. According to Chang and Wang (2011), there is a direct correlation between customer satisfaction and intent to repurchase.

*E-Customer Satisfaction and E-Repurchase Intention*

Table 4: Summary of H3

No	Relationships	Original Sample	Sample mean	Std. Deviation	2.5%	97.5%	T statistics	P Values	Results
H3	ECS->ERPI	0.827	0.826	0.026	0.767	0.871	31.556	0.000	Accepted

Source: Survey (2022)

The results shown in Table 4 demonstrate the empirical validity of that hypothesis. Businesses can affect their consumers' propensity to make subsequent purchases by improving customer satisfaction in online transactions, claim Shin, Chung, Oh, and Lee (2013).



Mediating Effect

Table 5: Summary of H4

No	Relations hips	Direc t effect	97.5% confidence interval of the direct effect	T value	P Value	Indir ect effect	97.5% confidence interval of the indire ct effect	T Value	P Value	Resul ts
H4	ESQ->ERPI	0.525	(0.370, 0.670)	6.911	0.000	0.321	(0.187, 0.468)	4.566	0.000	Partia l

Source: Survey (2022)

Table 5 demonstrates that neither the 97.5% confidence intervals nor the indirect effect of ESQ->ERPI statistical significance encompass zero values. As a result, it was shown that both the direct and indirect effects are important. Therefore, based on the findings of table 5, it can be empirically proven, according to Hair et al (2017), that e-customer satisfaction partially mediates the one correlations of ESQ->ERPI.

Moderating effect

Table 6: Summary of H5

No	Relationships	Origin al Sample	Samp le mean	Std. Deviat ion	2.5% %	97.5 %	T statis tics	P Valu es	Results
H5	Moderating effect	0.022	0.021	0.015	-0.088	0.052	1.397	0.163	Rejected

Source: Survey (2022)

The analysis results in the interaction term t values 1.397 for path linking the interactions terms of ECS and ERPI, as shown in the table. Additionally, the research results in linking interaction terms of ECS and ERPI with p values of 0.163 for each. The bias corrected bootstrap confidence intervals for the interaction term's impacts of ECS are (-0.088, 0.052), respectively, because zero includes all of them. It is statistically significant that the zero includes all of the bias-corrected bootstrap confidence ranges for the ECS. Overall, the statistical evidence shows that the interactions between e-customer satisfaction and e-repurchasing intention moderate the link.

Importance-performance map analysis (IPMA)

The PLS-SEM analysis can be used to determine the relative value of various constructs in explaining different structural model elements. To draw conclusions, one must understand the significance of constructs. The importance-performance map analysis (IPMA), which also takes into account the effectiveness of each and every construct, produces the PLS-SEM results. As a result, conclusions concerning importance and performance are possible, which is crucial for planning managerial actions. Attention should therefore be paid to the performance of those constructs that, despite having a relatively poor performance, demonstrate a high relevance in terms of how well they explain a particular target construct (Hair, et al., 2012).

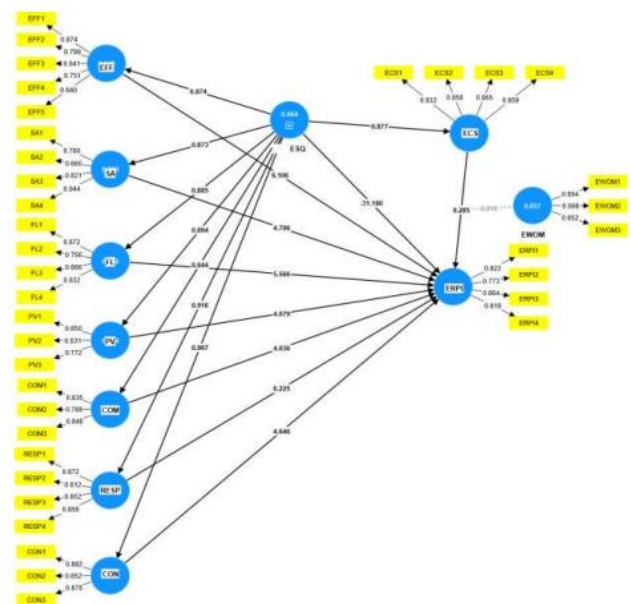


Figure 6: Path Coefficients  
Source: Survey Data (2022)

III. DISCUSSION AND CONCLUSION

From the PLS-SEM Importance Performance Map Analysis (IPMA) mentioned in this study, several significant conclusions led to recommendations. The descriptive analysis reveals that customers are very interested in the consumer gadgets that are covered in great detail in chapter four. It was also discovered that the primary element affecting future decisions to buy consumer electronics online was the customer's level of happiness. The statistics show that three of the seven ESQs—Efficiency, Fulfillment, Privacy, and Compensation—have a significant positive influence on the intention to conduct an online repurchase, however Fulfillment has a smaller influence than Efficiency and responsiveness. Customer satisfaction serves as a partial



mediating factor in the relationship between eservice quality and e-repurchasing intention.

*Interpretation of the IPMA of the unstandardized effects (constructs)*

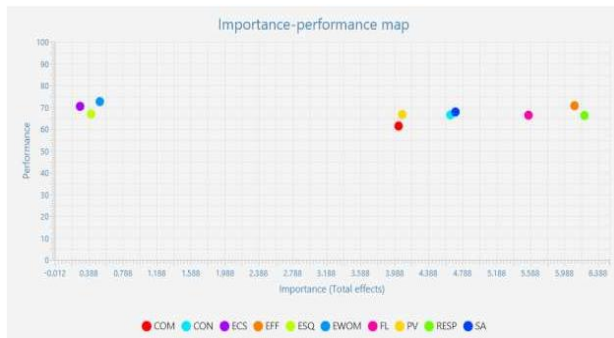


Figure 7: Unstandardized Effects (Constructs)  
Source: PLS IPMA Output (2022)

The component with the highest importance and the lowest performance, according to Sarstedt (2016), is specifically pertinent for managerial activities. There is a ton of space for improvement because that particular build performs so terribly. Since RESP, EFF, and FL have the strongest positive significant influences on the ERPI and ECS, management activities are chosen for them with the highest priority and lowest performance in this context. As a result, the most significant structures enhancing the ECS are picked using the IPMA developed for e-service quality dimensions Vs. ERPI (Sarstedt 2016).

*Interpretation of the IPMA of the unstandardized effects (constructs)*

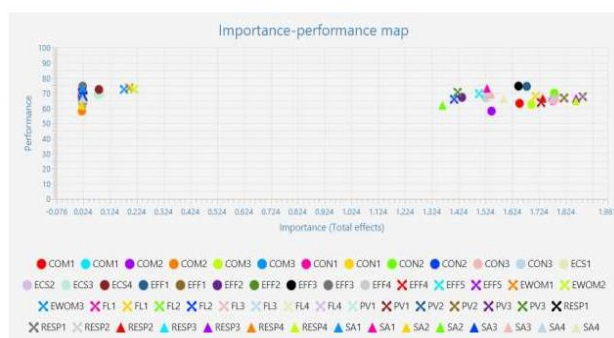


Figure 8: Unstandardized Effects (Indicators)  
Source: PLS IPMA Output (2022)

According to Sarstedt (2016), the indicators that can be seen in the rightmost portion of figure 5.2 have a high importance as well as a high performance. These variables (indicators of ESQ dimensions) should be improved in the following order of importance in order to increase e-repurchasing intention. The researcher presented a compelling argument in the section above that, in order to improve the ERPI, the ESQ dimensions should be improved first. In turn, the ESQ dimensions should be

adjusted in order to improve the ECS. According to Sarstedt's (2016) suggestions, the IPMA for indicators (Unstandardized effects) is used to identify which indicators need to be improved.

*A. Contribution*

The results of this study show that website quality needs to be adequately assessed and managed by marketers of general content-rich eservices. Businesses need to have reliable, flexible, and accessible websites because customers need to think highly of their products. creating a website with quick access to content and extra features Flexibility-enhancing features are essential for competitive differentiation. These e-services can stand out in the plethora of websites by making theirs easy to navigate, which is made possible by effective listing with the appropriate search engines and having links to websites that are contextually linked and include pertinent key words.

*B. Limitations*

The participants in this study who are capable of answering questions had never previously made a purchase from an e-commerce website. It is desirable to include more participants in forthcoming studies who have all done e-commerce purchases in order to obtain more precise data regarding the qualities of service quality. The main focus of this study is on Sri Lanka's population and how they view consumer electronics from local e-tailors; the sample was selected based on the number of online users in the nation, when 9.2 million individuals are present. As a result, districts, cities, and even provinces may have different levels of e-customer satisfaction. Additionally, remote areas with varying geographies and economic conditions may have different attitudes and perceptions of e-tailors toward consumers of consumer electronics even inside the same city limits. Additionally, information was acquired utilizing an online survey platform and a judging mode sampling technique. Therefore, to reduce the potential selection bias issues, future studies could use multi stage mixed sample rather of judgment mode sampling.

*C. Future studies*

Greater generalization requires a larger sample size since generalizability problems can occur within cities, districts, or provinces. Furthermore, Sri Lanka differs from other emerging countries with different surroundings in a number of sociological, economic, and geographic ways. It is additionally challenging to extrapolate findings to other industrialized nations with varied economic, social, and geographic aspects because Sri Lanka still lacks a sufficient number of e-services. Since the author's research was restricted to consumer electronics devices and was done specifically for those products, future researchers can use the same approach for new industries or products.

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## ABBREVIATIONS AND SPECIFIC SYMBOLS

ESQ	E-Service Quality
WOM	Word-of-Mouth
EFF	Efficiency
FUL	Fulfillment
SA	System Availability
PV	Privacy
CON	Contact
RESP	Responsiveness
COM	Compensation
ECS	E-Customer Satisfaction
ERPI	E-Repurchase Intention

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She was born in 1996 in Sri Lanka. After the school education, she entered the University of Sri Jayawardenepura for Bachelor's Degree in Marketing. She pursued the Master of Business Management in Marketing at University of Kelaniya. She is an academic writer and lecturer who specializes in Marketing. She is passionate about helping undergraduates understand marketing through her easy tactics. In her spare time, she loves to travel and music. You can find her on LinkedIn or Google Scholar.

# Psychological Factors that Lead to Nature-Based Adventure Activities, with Sustainability and Technological Approaches

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**Abstract**— *Tourism is one of the principal economic foam of Sri Lanka and relies remarkably on its destinations. Nature-based adventure parks become a sustainable source of economic, social, and environmental development linked through tourism. The present study aimed to identify the psychological factors that support improving foreign tourist attraction in sustainable tourism development with the technology effect. The tourists were interviewed through the questionnaire and observed data of sociodemographic and psychological factors of 82 participants on the location of the adventure parks in Sri Lanka. Most Males (75.61%), followed by females (24.39%) with visitors were between the ages of 25-30yrs (42.76%), ages 15-20 (18.87%), 20-25 (27.68%), and above 30yrs (10.69%). Foreign visitors were engaged in activities with 62.20% of their friends, 39.02% of their families, 14.63% of alone, and 14.17% of other individuals who were specifically visiting for tourism. The data were analyzed through Microsoft Excel and SPSS Software. From the study, it is revealed that most tourists are attracted due to the Fun/Adventure experience (8.63%), Thrill (8.27%), and stress buster (7.84%). These factors were major tourist attraction factors. However, improved technology has reduced risk and received the lowest average (3.67%). That was a negative part of the Sri Lanka adventure park availability. According to these findings, Tourists seek Fun/Adventure, thrill, and stress release through their journey. But due to lack of technology use is demotivated to attract again here. So, it is better that Adventure Park owners/managers should consider increasing the fun/adventure, thrill, and stress buster factors by improving the technology assistant for sustainable nature tourist development*

**Keywords**—Adventure tourism, Mental-wellbeing, Motivation, Sustainable, Technology

## I. INTRODUCTION

Tourism is an important source of export sustainable economic development in the countries (Milne & Ateljevic, 2010), and Sri Lanka also reversionary benefits from it (Anushan, 2017). The diversity of the geographical locations, cultural aspects, unique history, and natural beauty attract engaging recreational activities for the people of Sri Lanka completely suitable destination

(Fernando, 2016). From a tourism perspective, there also can find out a strong relationship between tourism and sustainability (Hanna, et al., 2019). In tourism, human psychology is based on environmental and social aspects that can affect the tourist's behavior, attitudes, and motivations (Simkova, 2014). Studies shows wealthy persons have engaged in those activities due to the breakdown of their monotonous lifestyles, mood fixations, higher life satisfaction, relaxation, life changes, reduce stress levels and improve work efficiency (Neal, et al., 2007).

According to the United Nation's Sustainable Development Goals its required tourism sustainability refers to "the development of tourism-related operations in ways that aid in global sustainability changes". The successful growth of nature tourism can be beneficial for environment sustain and for people relation with nature protection (Nation, 2022). Ensuring a balance between social, environmental, and economic consequences of tourism is all that becomes sustainable tourism (Štrba, et al., 2022). In sustainability, tourism is based on nature and is often considered as the tourist influence to environmentally friendly, attitudes development, knowledge and personality development" (Nicole, et al., 2015). This is mentioned in relation to nature-based tourism can embrace because it is believed that using modern concepts of sustainability will strengthen the validity of the research (Force, et al., 2017).

Further, (Barriga, 2017), sustainable tourism comprises a variety of techniques, including adventure tourism, ecotourism, and birdwatching. In this regard, ecotourism is sustainable from a social and environmental perspective. However, according to Fennell's study (Fennell, 2021) the adverse impacts of new technology, safety and health issues, financial losses, and disasters on the environment and it brings about in a new era of travel and tourism instead of using harmful methods that disregard people, destinations, and the environment. Present, tourism promoters have a chance to rethink tourism in new ways and promote travel with a positive effects (Everingham & Chassagne, 2020). With respect to all this there were important to identify the factors which tourist was attracted to Sri Lanka nature-based adventure activities. For that,

this study evaluates visitors' motivation factors and potentials of their plan to travel again.

## II. METHODOLOGY

This cross-sectional descriptive study was carried out on 82 participants of the foreign tourist adventures who participated in the Activation base, water-based and land-based activities around the recreational activity's centers from March 2022 to May 2023 in Sri Lanka. The sample was both male and female participants who were between 15 to 35 years. The study objective was to identify the motivational factors that they attracted to nature-based adventure parks with sustainable and technological interventions. The data was gathered by visiting the adventure parks and filling out the questionnaire by interviewing them. The sample size was participants who were willing to answer questions during the study period in these locations through the snowball sampling methods. For this study tourists with differently-abled persons were excluded due to their perceptions could be varied. The persons who are not willing to engage in activities are also excluded. The questionnaire was designed to comprise two sections including the first section on sociodemographic characteristics, and the second section dealt with the motivations for making the adventure tourism trip with contained 15 items that were motivations linked around sustainability. The motivation scale was measured using a 5-point Likert scale, where one means the lowest and five the highest. Then After the well-informed objective of the study questionnaire was provided. After completing the data collection all data were included in the Microsoft Excel sheet to analyze the data. After data collection data was analyzed using SPSS version 20 (SPSS Inc., Chicago, IL).

## III. RESULTS AND DISCUSSIONS

Initiate the study by gathering sociological data to identify the sample.

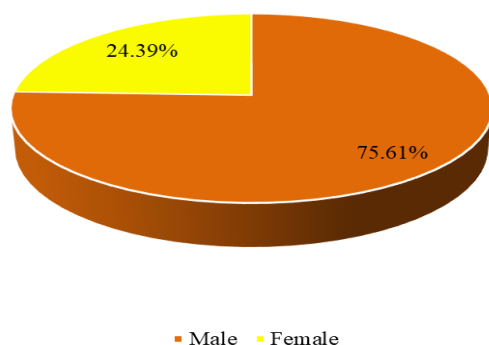


Figure 1. Tourist with genders

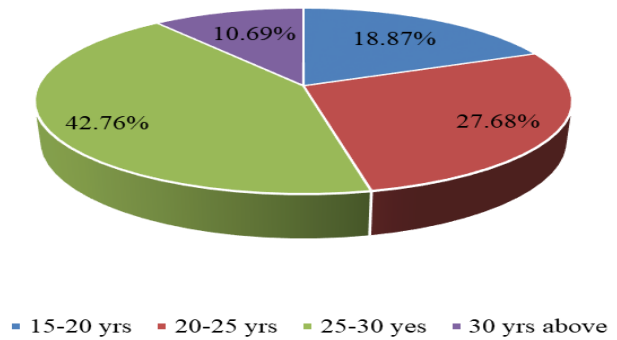


Figure 2. Tourist with ages

For the study, the sample comprised foreign tourists with their perception of nature based activity engaged tourism. Males (75.61%) made up the largest group, followed by females (24.39%) shown in Figure 1. Figure 2 shows the majority of visitors (42.76%) were between the ages of 25 and 30, followed by visitors between the ages of 15 and 20 (18.87%), 20 and 25 (27.68%), and above 30yrs (10.69%). Foreign visitors participated in activities with 62.20% of their friends, 39.02% of their family, 14.63% alone, and 14.17% of other individuals who were specifically visiting for tourism shown in Figure 3. It becomes clear during the conversation that they were visitors with a recreational intent and were here on business.

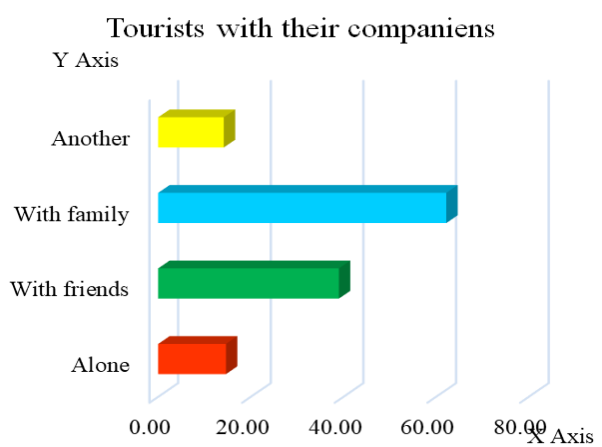


Figure 1. Tourists with their companies

In order to promote sustainability through economic growth during a time of economic crisis, this study's significant findings recognized five important factors. The primary goal of the current study was to discover the factors that lie behind demand in an adventure location in order to ensure the tourist industry's sustainability over the long term, results are shown in Table 1.

Table 1. Factors that lie behind demand in an adventure location

		Factors for Activation base Adventure sports	Factors for Land base Adventure sports	Factors for Water base Adventure sports	Average prioritizes	
		Mean+ Median			%	Order
01.	Thrill	4.32+4.00	4.43+5.00	4.00+4.00	8.27%	2
02.	Requires zeal	3.58+4.00	3.56+4.00	3.42+3.50	6.15%	12
03.	Spells status	3.24+3.00	3.09+3.00	2.92+3.00	6.86%	6
04.	Builds confidence	3.50+4.00	3.49+4.00	3.48+3.50	6.45%	8
05.	Helps in personality development	3.80+4.00	3.65+4.00	3.47+4.00	6.31%	10
06.	Instills self-belief	4.38+4.00	3.33+3.00	3.42+3.00	6.26%	11
07.	Creates unique identity	3.64+4.00	3.47+3.00	3.44+3.00	6.37%	9
08.	Stress buster	3.10+3.00	3.05+3.00	3.83+4.00	7.84%	3
09.	Helps in goal-setting	3.39+3.00	3.25+3.00	3.83+3.00	6.91%	5
10.	Is challenging	3.39+3.00	3.44+3.00	3.43+4.00	6.10%	13
11.	Requires toughness	3.05+3.00	3.07+3.00	3.02+3.00	6.12%	14
12.	Builds sense of achievement	3.53+4.00	3.42+3.00	3.53+4.00	6.61%	7
13.	Is a unique experience	3.93+4.00	3.94+4.00	3.42+3.50	7.46%	4
14.	It is fun/adventure	4.18+4.00	4.10+4.00	3.66+4.00	8.63%	1
15.	Improved technology has reduced risk	3.27+3.00	3.27+3.00	2.83+3.00	3.67%	15

The following classification has been used to group these motives including physical, such as relaxation; cultural, interpersonal, such as socializing; and meeting new people; such as discovering new geographical areas and prestige, such as self-esteem and self-actualization. The most significant factor was, "It is fun/Adventure," which has the most significant potential to explain the total variance, affecting 8.63% of totally of them. According to the studies, the fun/adventure factor contributes to tourists' contentment. The adventure variable was thus a finding of the study because both the literature review and the study's findings contained that dimension. The study also found that also supports escaping stress, tension, relationships, and escapism apart from fun and enjoyment (Sirgy, et al., 2010). The second factor was "Thrill" which reached 8.24% of the total variance. It is defined by a sudden feeling of excitement and pleasure (Buckley, 2018) explained by a behavior related to the feeling of challenging to break the monotonous lifestyles of which they had. These researchers stated that the Thrill aspect results in satisfied guests. The study of the Giddy also

emphasized the tourist more seeking the thrill during their travels.

For the third factor, "Stress buster", the study has shown that it included 7.84% of the total variables. It is concerned with the physical and mental health of the tourist. This is tourists' reason for visiting an adventure destination scoping with relaxing, resting, getting away from the hustle, and escaping the montunoes life style of the daily routine tension and stress. Concerning the motivational dimension of relaxation, some authors have similar findings, Naidoo et al., found relation and refresh (Naidoo, et al., 2015). As well as Bichler and Peters also found it as a motivation for relaxation (Bichler & Peter, 2021). On the other hand, Pop et al., discovered that stress levels had decreased. In order to enhance the stress release component of adventure sports attraction, rest and relaxation places could also be incorporated into adventure sports travel along with Yoga practices (Pop, et al., 2023).

The quantity of quality the tourists perceive from and associated websites can also be influenced by functional and technical characteristics (Vassiliadis1, et al., 2013). The challenges pertaining to the area with infrastructure, technological and innovative features, management of the use of space and its sustainability, and the geographic arrangement of these activities are taken into consideration. It will operate as a foundation and vital resource for leisure and outdoor enjoyment on the property, as well as the practices of adventurous activities as vectors of tourism goods. But the most identifies factors ware there were least average as the improved technology used for the reduced risk with 3.67% of the total variables. The study of the Arie also found that poor technological support also reduces foreign tourists' attraction due to lack of information and poor safety (Reichel, et al., 2001).

#### IV. CONCLUSION

Sri Lanka has a unique tourism-based economic culture and needs to promote sustainable tourism for environment protection. Adventure tourism is mostly based on nature and leisure activities and these are based on physical activities with intensity, risk, pleasure and motivation. After the pandemic period, it was important to conduct the study for identifying demand and motivations factors for sustainable development in the tourism field. Adventure tourism revealed that fun and adventure, thrill and stress bursting were the major motivational factors to engage. But the technical application was indigent level and it discouraged the tourists from active participation. These findings can use adventure park owners/managers to implement their development plans to provide better service to increase tourist attraction. They should pay attention to the development of technical aspects to increase attraction in this technical era. Future research



could be beneficial when exploring the connection between travel goals and spending in adventure locations. It will be important to strengthen the adventure tourism attractions by offering tourist protection and building locations where adventurous activities like paragliding, snorkeling, trekking, and parasailing. It may be carried out in order to increase the competence mastery dimension.

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# Female Visionary Leaders for Development: A Sociological Reading on Importance vs Reality of Gender, Development and State University Education in Sri Lanka: A Case Study

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**Abstract**— *Visionary leadership is more about having a long-run vision. Sustainable development is a holistic approach to development. The country's state universities provide free-of-charge higher education for selected students based on their Advance Level examination results. The research problem of the study was 'what is the importance of having female visionary leaders in navigating the country's development process?'. Research objective was to 'examine what is the reality of including female scholars of state universities of the country as visionary leaders, within the country's development process'. This research was an exploratory, qualitative, field-based research. Purposive nonprobability sample was used, collected primary data through questionnaires and structured interviews. Discourse analysis was used in analyzing data. Since this was done by selecting a state university and 8 selected ministries of the country, this is a case study particular to those main research fields. Enhancing equal participation in the private and public spheres need gender-sensitive lenses. The popular view on leadership as which belongs to the public sphere restricts females' full participation in leadership, in a patriarchal world. Patriarchy has created a mindset that working under female/s is somewhat inferior. Although a considerable number of females are engaged in labour force of the country, bringing female visionary leadership into the mainstream is lacking. Theoretically state university curriculums made treating males and females, the other gender groups equally. There are clear gender patterns in male-female student proportions in different study streams; those are bounded by gendered social constructions and gender-based division of labour. Females are not genetically less visionary. Where the state policies do not promote female visionary leadership to navigate the development process of the country, it is difficult for females to cope with up challenges they face.*

**Keywords**— *Development, Gender, State Universities*

## I. INTRODUCTION

According to the literature review of this research, it is clear that recent most studies have been done regarding female labour in the country's labor force, female leadership despite female visionary leadership, and more on female leadership in the entrepreneurship and

corporative world. This is a long-standing issue. Gender asymmetry can be seen in education, training, and professional work, even in developed countries. Sri Lanka shows better rates in gender-related matters compared to other countries of the region. Picking development models which suit the Sri Lankan context would provide more effectiveness and efficiency to achieve sustainable development. The overall idea of development is to make a better life for everyone, expand the freedom of people, and go beyond a narrower understanding of development. The Sri Lankan education system at present consists of state and private sectors in schooling, university education, and vocational training. State university education is totally free of charges for undergraduates after introducing the free education policy to the country. State university education has been making a significant contribution towards national development, ensuring equality in education. However, it has also been experiencing challenges in enhancing its quality relevance to facing global advancements in education. Data collection methodologies need to enhance identifying gender-sensitive issues.

The nature of females' inclusion in different societies varies according to their social, economic, cultural, environmental, and political contexts, even within one region. Any systems which pull out females would not ensure their inclusion and would not take their visionary leadership to the mainstream. The fact of different gender patterns has been taken to attention by many scholars. With the expansion of university education for the masses, especially as a way of inclusion around the globe, which has influenced the universal model of university education, its prime task is considered to improve critical thinking, which would prepare students for graduate professions, as a secondary focus. Enhancing equal participation and compensation, both sectors of the private and public spheres need to have more pragmatic views on the concerns of females. Sustainable development is a holistic approach to development, including three key aspects of economic, social, and environmental development, which is the most concerned development model of the present world. Visionary leadership is somewhat goes beyond leadership.

visionary leadership does have a long-run vision with clarity, and working towards that in a very pragmatic,

strategic way. Although a considerable number of women are engaged in labour force in the country, in most societies bringing female visionary leadership into the mainstream is lacking. Females have better estimations of themselves than men rates women. Envisioning consists of broader scope, including working for a long-term plan with a clear mission, working with different stakeholders and at different levels, which are significant for them to realize and maintain consistency of envisioning. Being visionary go beyond merely being charismatic.

In such a context where the state policy of development of the country are not promoting women visionary leadership to navigate development process of the country, it is difficult for women to cope with up challenges they face. Although Sri Lankan state university education system makes a considerable contribution in including women visionary leaders in the development of the country who could lead the country's development process, practices existing in state universities have few drawbacks. State universities are a cross-section of the country and considered as a place where full of intellectuals. If we see gendered prejudices among such intellectuals in practice, it's obvious to see that in the broader society.

It is not a mandatory role of state university curriculums specifically to make and include women visionary leaders in the development process. Curriculums are different in different study streams, and those have generally made treating males and females, as well as all the other gender groups, equally. Curriculum plus personal choices, personality, values, and attitudes do have a strong impact on including women visionary leaders in the development process.

## II. METHODOLOGY

### A. Research Problem

What is the importance of having female visionary leaders in navigating the country's development process?

### B. Research Questions

- 1) What is the contribution of the state university curriculum regarding the inclusion of women in the present Sri Lankan development process?
- 2) What are the social and cultural factors that have penetrated into the Sri Lankan state university education system affecting women's inclusion in the present development process in Sri Lanka?
- 3) What is the relationship between the state university education system and creating female visionary leaders at the decision-making levels?

### C. Main Research Objective

Examine what is the reality of including female scholars of state universities of the country as visionary leaders, within the country's development process.

### Sub Research Objectives

- 1) Critically understand orientation of development agenda in present Sri Lankan development discourse.
- 2) To examine the contribution of women in the state university education system of Sri Lanka as visionary leaders in the process of development.
- 3) Examine the nature of gender aspects which effects the inclusion of women in the process of development with in present Sri Lankan state university education system.

### D. Research Field

Primary data has been selected from below mentioned faculties and campuses of the University of Colombo, Sri Lanka as below and from the government institutions selected through secondary data.

- Faculty of Arts.
- Faculty of Science.
- Faculty of Technology.
- Faculty of Law.
- Faculty of Education.
- Faculty of Management and Finance.
- Faculty of Nursing.
- Sri Palee Campus.
- University of Colombo School of Computing.

The University of Colombo is considered as a leading university within the country's state university education system because of its knowledge production and higher number of academics and scholars. This research is a case study which has been collected primary data from above mentioned faculties of the University of Colombo and ministried below has mentioned.

Ministries where primary data collected were as below,

- Ministry of Social Services.
- Ministry of Higher Education.
- Ministry of National Policies & Economic Affairs.
- Ministry of Public Administration & Management.
- Ministry of Health.
- Ministry of Agriculture.
- Ministry of Labor.
- Ministry of Environment.

### E. Research Sample

There were two samples in this research. The first research sample was the academic staff of the University of Colombo, and the second research sample was administration-level positions of 8 selected government

ministries. Considering the size of each study population, in order to protect the generalization of findings and reliability, a minimum of 10% from each research population was included within the sample. Further, by using purposive sampling under a non-probability sample, obtaining specific details from specific persons who have specialized knowledge regarding the research problem was expected. Ensured gender balance in the sample. To protect and enhance generalization of findings and the reliability of data, sampling with replacement has been used. Conducted a total number of 87 structured interviews and collected primary data from 132 questionnaires in total.

### III. DATA COLLECTION

This research was an exploratory research. As this study is a qualitative research, qualitative data collection methods were used. However, the questionnaire survey method was used to collect basic demographic and main statistical details. Structured interviews were done as a qualitative data-collecting method. Therefore, triangulation has been done. There were 3 stages of data collection as below, Stage1– Distributing questionnaires among administration staff of the said faculties and campuses of the University of Colombo and selected government institutions.

Stage 2 – Using the data gathered in stage 1 by questionnaires, the main issues and problems were recognized. Those main issues and problems were discussed further through structured interviews.

Stage 3 – The main issues and problems recognized by stages 1 and 2 of data collection were discussed with the key informants to have a much deeper understanding. Statistical reports, books, reports, etc., on state university education, gender and development were used as secondary data in data analysis.

### IV. DATA ANALYSIS

Mainly qualitative data analysis methodology has been used. Discourse analysis was used as the main qualitative analysis method. Using the discourse analysis method, it has critically examined and discussed the country's current development and higher educational discourse, combined with gender aspects that can be seen in the country. Further, society's general discourse and policy level discourse about gender and education were discussed.

Ethical considerations towards respondents, data, and institutions were protected. Research was conducted only with the permission of the deans of each faculty, without disturbing the normal function of university routines. Participation in the research was only with respondents'

voluntary consent and highly protected privacy and identity of the data.

### V. METHODOLOGY

Vision plays a major role in Leadership. A visionary leader has to have excellent strategic analysis and rigorous implementation plans to make their plans a success. A research paper by Ibarra and Obodaru (2009) explains the visionary Leadership of females and its importance in relation to the business environment. They have mainly discussed why females are considered visionaries or why are women not considered visionaries (Ibarra and Obodaru, 2009: 56-57). There are plenty of discussions, debates, policies, etc., on improving or facilitating female's labour force participation while bringing female's visionary leadership to the mainstream in reality is still lacking. In most instances, female's visionary Leadership has been discussed in relation to the business or corporate world, while discussing female's leadership in relation to the development process is lacking. Ibarra and Obodaru (2009) evaluated 10 dimensions of leadership as below,

1. Emotional intelligence.
2. Empowering.
3. Energizing.
4. Envisioning.
5. Global mindset.
6. Organizational designing and aligning.
7. Outside orientation.
8. Rewarding and feedback.
9. Team building.
10. Tenacity.

According to the said research, literature on gender and leadership suggest, female executives are less highly rated than their male counterparts; however, according to findings of the research, they have found that female business executives were rated higher than their male peers. They considered how females scored themselves, and that was higher than how their male counterparts rated themselves regarding the first four dimensions from the above 10 and the same regarding the other 6 dimensions. Therefore, as evidence shows through the research, women have a better estimation of their own abilities compared to their male peers. Again, they had insights into how peer groups score females in this regard (leadership dimensions). Here, men gave women a higher score than their fellow men regarding the first 07 leadership dimensions. However, female respondents have responded by positioning females on edge on eight. As one major point, while women hold higher rates compared to their male peers in most of the 10 leadership dimensions, women scored much lower on 'envisioning'" (Ibarra & Obodaru, 2009: 58-59). "Envisioning" was defined here as "articulating a compelling vision, mission, and strategy that

incorporates a multicultural and diverse perspective and connect employees, shareholders, suppliers, and customers on a global scale" (Ibarra & Obodaru, 2009: 58-59).

Having a compelling vision means having a long-term plan and a mission which means a way how the vision will be implemented, with a pluralistic and broad point of view. Working together with different stakeholders and different levels is important in realizing and ensuring consistency of envisioning. "Vision" consists of the ability to frame practices, generate new ideas and strategies, and communicate possibilities for others in an inspiring way. Visionary Leadership goes beyond just being charismatic, and there would be no leadership without a vision, as vision is fundamental to being a better leader. 'Vision' and 'Leadership' have an intimate relationship. 'Envisioning' is more about being forward-looking, having the possibility to share a view of the future (Ibarra & Obodaru, 2009: 59). "Also, this research has described "why females fail to impress with their vision". To have deeper insights into this, they considered the below key questions which are "Are female leaders really less visionary than men?"

- "Is it just a matter of perception?"
- (Ibarra & Obodaru, 2009: 59)
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According to the data gathered through female executives, this research has provided 3 explanations in this regard.

1. "Females are visionary but in a different way."
2. "Females hesitate to go out on a limb."
3. "Females do not put much stock in vision."  
(Ibarra and Obodaru, 2009: 59).

Ibarra and Obodaru (2009: 59–60) further explain the above factors below,

1. "Females are visionary but in a different way."

As responded by the females who participated in that research, women do not lack vision, but they formulate their vision in a more collaborative way than males. They emphasized how it helps to seek solutions and maintain its own structures and innovativeness. Here they considered, "who says females are not visionaries?". According to the findings of said research, in most instances, female peers rate other female peers as highly envisioned. However, male peers and female superiors are the ones who say females are visionaries (Ibarra & Obodaru, 2009: 59). There is an attitude in society that people cannot be visionary unless they are highly visible, and it has a negative impact on female visionary leadership.

2. "Females hesitate to go out on a limb."

Females need not be reluctant to take credit for having a shared vision. Here it has been highlighted the need to improve female's confidence to speak and back up what they say with a strong base of facts.

3. "Females do not put much stock in vision."

According to data gathered from female managers of said research, females do not give importance to "vision"; some say that females give more consideration to practical things and females have a sound sense of human dimensions. While men were busy promoting themselves, females were getting on with their work behind the scenes, as found in this research. This reflects how female's image of visionary leadership goes back and is hidden. Female's image is hidden by men's efforts to maintain and promote themselves. In most instances, people are continuing how they are showing strength and effectiveness in handling their jobs. Outspoken actions play a significant role in this. However, the issue is the risk of erasing females, or female's performances are hidden because of this. Because of this, a man who emerged by backing females will appear as the leader instead of the shadow female who backed this man appear as the leader.

It is important to study the question whether females lack respect for being visionaries or are females not visionaries at all. Regardless of the sector they are involved in, it is important for females as they must overcome their natural distrust of "being a visionary" to reach the top. Further, females need to be prepared to promote their contribution as visionaries. Females face greater challenges in expressing their vision, although they already have the characteristics of being visionary leaders.

"Gender mainstreaming" is an important concept to address issues regarding the inclusion of visionary female leaders in the development process of a country. This concept has evolved into a broader context over time and now generally refers to a comprehensive strategy that involves female-oriented programs and gender issues integrating programs which is a factor that needs to be included throughout the program cycle of those programs (Gunawardena & Jayaweera, 2008: 01). Female's equality is a right, and it is included and emphasized in Millennium Development Goals as one main goal to be achieved.

Gender mainstreaming is a significant factor in achieving gender equality. According to the Council of Europe (1999) (Council of Europe, 1999 cited in Gunawardena and Jayaweera, 2008: 02), organization, improvement, development, and evaluation of the policy process are included in the definition of gender mainstreaming. Gender mainstreaming is fundamental in addressing gender issues, and it is a necessary strategy to prevent the marginalization of female's needs and address inequality which is a result of unequal power relations existing between men and



females within the society and institutions involved in the development process of a country. Therefore, gender mainstreaming is a "transformative" strategy (Kabeer and Sabrahmanian, 1996, cited in Gunawardena and Jayaweera, 2008: 02). Incorporating a gender perspective in policy development, research, advocacy, dialogue, and legislation is central to achieving gender equality (Gunawardena & Jayaweera, 2008: 02).

Goal 3 of the Millennium Development Goals focuses on promoting gender equality and empowering females. And Goal 4 of the Millennium Development Goals focus on eliminating gender disparity in primary and secondary education (Gunawardena & Jayaweera, 2008: 08) SDG 5 focuses on achieving gender equality and empowering all women and girls.

A research paper by Wickramasinghe (2012) has considered combining theoretical and practical aspects of the discussion on gender in university structures. It has considered female's participation, representation, training, encouragement, and empowerment of individual females in university structures. Further, it considered the improvement of female governance structures and power positions in universities. The theoretical approach to gender has considered gender roles, responsibilities, needs, issues, relations, and politics of gender. Also, it has explained institutional structures, practices, and cultures. It is also important to think of the fact that gender is not only about females, and it also needs to consider men's issues as well. Earlier consideration of gender was focused only on females. However, nowadays, broadened debates on gender consider both men and women (Wickramasinghe, 2012: 13).

Personal focus on gender issues has shifted beyond personal and given legitimacy to the consideration of issues such as social justice, institutional responsibility, diversity, ethical work practices, social relevance, academic excellence, organizational efficiency, international and national legal standards, etc. (Wickramasinghe, 2012: 14). There are a few arguments that try to justify socially constructed gender-related prejudices such as,

- Cultural argument.
- History argument.
- Common sense argument.
- Nature argument.

Wickramasinghe (2012: 22) explain those as below.

The cultural argument can be seen mostly in Commonwealth countries. There is a perception that is seeing gender equity and equality as western concepts that hinders their own cultural values. They see gender equity and equality as a concept that damages the "purity" of local women as well as a 'western' concept that came

through globalization. According to the nature argument, roles, responsibilities, characteristics, and behaviors of women and men are considered as something created by nature. Therefore, gender equity and equality are seen as unnatural or something against nature. The history argument on gender considers the status and roles of men and women as historically assigned factors. Therefore, those who believe this argument consider that there is no necessity to change these states of affairs. According to the commonsense argument on gender, men are traditionally considered breadwinners of a family, and because of that, men have to work in the public sphere in workplaces, and women have to take care of domestic work, which is considered the private sphere. One main factor connected to this is females are bound with prejudices connected to their pregnancy and childcare experience. There is a perception coming from the commonsense argument that pregnancy and childbirth would make disruptions for the institutions where females are employed. In the context that females have achieved things in the public sphere, these arguments can be noticed as barriers and factors that hinder gender equity and gender equality. Gender equity and equality are two main concepts discussed in gender mainstreaming. Through said arguments, in most instances, they see concepts of gender equity and equality as something against men and family. Also, some females tend to claim that their work life or careers are not influenced by these discriminations, while some tend to see it as an influence. Most importantly, relevant stakeholders need to be well-prepared to address and encounter these issues.

According to the nature argument on gender, sexual differences between females and males, as well as LGBTQI<sup>1</sup> population, are created by nature. Females' roles in pregnancy and childbirth are considered biological roles for her within the family. In contrast, according to the sociological argument on gender, gender differences are created socially and culturally, these have to be vigorously legally recognized in workplaces, and it has to strengthen the fact that both men and women can nurture a family and share parental responsibilities within a family.

Wickramasinghe (2012) identified significant factors connected to gender mainstreaming in the Sri Lankan university context. These prejudices and factors need to be taken seriously when addressing issues that are connected to the inclusion of women as visionary leaders in the development process of the country. In the present society, men's and women's self-definition is not merely

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<sup>1</sup> LGBTQI- Lesbian, Gay, Bi-sexual, Transgender, Queer people.

defined by nature. Here there are a few interesting factors to consider as below (Wickramasinghe, 2012: 23).

- Traditional patterns of sex are influenced by new scientific interventions.
- From one point of view, concepts of nature and biology are socially constructed, as the "concept of science" is socially constructed.

When considering gender commonalities and differences, those are not scientific and are subject to changes depending on time, geographical location, crisis situations, age, etc. (Wickramasinghe, 2012: 23). Organizations also can be gendered, depending on several factors such as who holds positional power, agenda-setting power, access to resources, influential networks, hidden powers, and valued skills, etc. (Module on Academic Leadership in the ACU<sup>2</sup> series cited in Wickramasinghe, 2012: 27).

Gender division of labour has become a crucial factor in organizations. According to this concept, in most instances, men are positioned in productive work, which will generate income, while women are positioned in unpaid reproductive work, which is mostly involved in maintaining a household or family (Wickramasinghe, 2012: 27). Here we can see a clear demarcation between social and public spheres, which is based on gender. Females are mostly positioned in the private sphere. Males have power and participation in both private and public spheres. Sometimes females have no power at all, even in their own private sphere.

Gender equality is referred to giving equal rights, responsibilities, and opportunities to men and women as well as girls and boys. It does not claim females and males should be the same. However, it emphasizes that rights, responsibilities, and opportunities for both males and females (Wickramasinghe, 2012, p.28). Gender equity refers to specific interests, needs, and priorities of males as well as females. According to this, males and females have different needs and priorities, and those depend on their biological sex as well as gendered life experience. Therefore, females and males prioritize different beliefs and different issues. The concept of gender equity and equality emphasizes the need to consider the similarities and differences of both males and females, which is important in achieving gender justice. Gender identification includes consideration of gender roles and responsibilities in the family as well as at the workplace and cultural practices at the national and international levels. These include expectations of dresses, appearances, behaviors, assumptions on intellectual and emotional characteristics, sexual orientations, needs, and

preferences of females and males (Wickramasinghe, 2012, p.28).

According to primary data of the research, when considering the fact that whether state universities in Sri Lanka have sufficiently included or not included female graduates who passed out from those universities within the development process of the country as visionary leaders, half (50%) of the respondents think that it is "yes", while the other half (50%) of them think it is "no". The majority (87.5%) say that it is because of the practices, and a considerable number of them think that it is because of attitudes (62.5%) and values (20%). They further responded as below,

"Women are considered to be less powerful and always get discriminated against" (Field Data, 2021-2022).

"Women can do administrative jobs, and also there are no limits to go do a job with their knowledge, it depends" (Field Data, 2021-2022).

"State university agenda has not excluded women" (Field Data, 2021-2022).

According to the data collected through the research, the power relations between females and males do have a significant negative impact on females' visionary leadership. In most instances, it positions females in less powerful positions while males are positioned in more powerful leadership roles. In contrast to that, according to the point of view of some respondents, females have no restrictions to do a job or hold any roles which are suitable for their knowledge, and the state university agenda does not exclude females. Although Sri Lanka does have a well-balanced university system, it needs to eliminate minor drawbacks.

Considering on reasons why present Sri Lankan state universities have insufficient inclusion of female graduates as visionary leaders in the development process of the country, the below responses are notable.

"Women are subjected to harassment and discrimination always" (Field Data, 2021-2022).

"State university agenda is same for both males and females. According to our country's cultural background, it makes women homebound. It should be changed" (Field Data, 2021-2022).

Harassment and discrimination against females hinder females' visionary leadership. Although state universities have no restrictions or barriers against females in theory, in practice, the cultural and social background of the country

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<sup>2</sup> ACU- Health and Fitness Education, Research, Career Support

restricts females only to be in the private sphere in most instances.

"I don't see any... I mean any such female graduate as visionary leaders who developed the country or who can contribute to the development process of the country. For example, there are some female academics inside universities; maybe they are only limited to their own university or maybe for some 2-3 universities" (Field Data, 2021-2022).

Although there are female graduates passed from state universities in the country who have the capacity and potential to be visionary leaders, most of them have not come to the public; their inclusion is restricted by themselves or by other factors.

"If you go to India, you can see female leaders. I mean, from the artistic level or from the movement level, there are leaders. But in Sri Lanka, there are women's organizations, but less women leaders. See women's organizations.... there are no women leaders from universities; they are just general women. We have not seen.... I have seen very few women in general forums which talk about visions of the country" (Field Data, 2021-2022).

In Sri Lanka, females' active participation in movements is less. Even though there are female visionary leaders, there are only a few who talk about the visions of the country.

"See, when you think of women who are very promising and studying in better streams, it is only a very few are from state universities in Sri Lanka. Some of them graduated from foreign countries or some other private universities in Sri Lanka but not from state universities. There is something missing; it may be data sometimes. There may be women who actually contribute to the development process of the country from the state universities. But they are not highlighted, or they are missing. It can be that the data is missing, or they are maybe working under some other big shots....."

Therefore, I think that it is sometimes not pointed out or statistically not visible to us, whether they are contributing to the development or not" (Field Data, 2021-2022).

In most instances, highlighted women visionaries in the country are mostly graduates from private universities or foreign universities. From another point of view, there are women visionary leaders who graduated from state universities; however, they have not been highlighted, or data about their contribution is missing.

"Their capacities, their creativity, and everything are lost when they started working as development officers.

Because they just have to go and visit homes and distribute plants and all. Very few only can come out from those very rigid criteria" (Field Data, 2021-2022).

Some positions which state university graduates are assigned in general do not facilitate them to enhance their capacities.

"In this faculty, the majority are obviously female. Of course, in other faculties, you have substantial numbers of women. But there are some differences. When it comes to medicine, a large proportion of females do that. So, the point is that women tend to be concentrated more in the liberal arts than in science" (Field Data, 2021-2022).

Different disciplines in state universities show different patterns of female and male student ratios.

"Mostly the leadership is on hands of men. That may be partly due to various constraints that they have. Because we still have those social and cultural conditions in the country. That prevents or discourages female graduates whenever they take such a position. That may be because of the long-standing division between public and private domains in Sri Lanka.....So, the point is this, when you have this divide between the public and private, there is a greater tendency of women to be in the private domain.....And you know, leadership positions are normally not at home; leadership positions are in the public domain.....There are exceptions to those sometimes, where there are women taking up leadership positions.....and such positions are being held by women, so there are various factors that contribute to this particular situation" (Field Data, 2021-2022).

Most of the time, there is a general assumption that males are the ones who are fit to be leaders, largely due to cultural beliefs. The gendered social constructions of the public and private spheres have greater impacts on this. Females are mostly treated as the ones who have to be at home, while males have to be in the private sphere. Further, gendered constructions of roles and statuses intensify this division which has been making negative impacts mostly on females. Division of the private and public sphere and gendered division of labour are the main reasons behind these patterns.

"I think in the area of women's activism, there again I see a difference. Students who are working connected to conventional political parties, I think there are much fewer females involved, people who do politics in universities, those who belong to mainstream political parties, they are much less likely to adopt women" (Field Data, 2021-2022).

Most of the time, leaders of the student unions of the research field were held by male students. Even in the



faculties which have majority of female students, this pattern could be seen. They have included very few female members to the union council, but in the recent past, there were no female students who held the higher positions in majority of state university student unions. This pattern can be seen even in the other students' societies in the university. Most of the time, female students are the ones who nominate those male students for leadership positions in those student societies. According to field data, the major factor that respondents highlighted here is female students are mostly considered as a group who cannot stay in public spaces at night and have traveling issues alone, and male students are stronger at facing challenges (for example –participating in protests, etc.). Here it is clear how the gendered concept of the public and private spheres impacts female leadership. This reflects the larger society as the university has students from around the country, with many subcultures and so on. It is a cross-section of the larger society. Even in such a diverse place with a spectrum of ideologies, we can see the gendered division of the public and private spheres, which hinders female inclusion.

"I think we need to really revisit two things. We have to ask what do you want? And what kind of opportunities we want to create for women, encouraging them going to leadership positions?" (Field Data, 2021-2022).

"Our political culture is a reflection of male domination. You know, sometimes it is violent, sometimes very much harsh. There is a particular kind of personality that fits into these politics. For instance, if you take leadership positions in administration, women are very few. You have a vast majority of men. You know....it reflects the social, cultural, political, and economic process of the country. So, there is a kind of natural selection; women have other responsibilities too. And those responsibilities constrain them from getting and playing leadership roles" (Field Data, 2021-2022).

The political culture of the country is dominated by the patriarchy, and it has worsened by the fact that women have internalized those and generalized these prejudices by their own selves. Femininity and masculinity have been defined by society through the concept of gender, and all the rest are bounded by that in society in most instances.

"So, they have gender roles. So, I think gender roles are still quite rigid in the country. You can work, but you know working is something different from holding a leadership position. Because leadership positions are far more demanding than occupying a job. I think we really need to have a public discussion on this. For that, some new thinking can be injected into the situation that we are in today. I think universities can play a role in that, not only through curriculum but through various courses as

well. Also, playing an advocacy role within the university system itself is important. Various stakeholders, such as students also have to come to an understanding" (Field Data, 2021-2022).

Attitudinal change with an ideological base need to have in order to change prejudices experienced by females in becoming visionary leaders. State universities have the potential to act as an agent in initiating and strengthening this process. As same as the state university academics, state university scholars also have to work collaboratively to change challenges faced by female scholars, graduates and accelerate more females are becoming visionary leaders who navigate the development process of the country.

"Actually, the leadership.... I think we cannot refuse that the university contributes to producing visionary leaders. University has a considerable contribution to producing visionary leaders. Because most of the leading women in the administrative leadership positions of the country are state university productions. But I do not think we contribute more to that. Because we produce visionary leaders, it is an optional thing in a university system. If you want to be a visionary leader or if I have an inborn potential, then I can develop that potential or whatever through this system because the system supports you. But the thing is, if somebody cannot recognize their potential or inborn talent to be a visionary leader, then we cannot get the expected outcome from the system" (Field Data, 2021-2022).

Making a visionary leader or enhancing the visionary leadership of female graduates is not a mandatory role of state universities. However, in general, state universities of the country are dedicated to strengthening the competencies of their graduates, which ultimately positively cater to the development process of the country. From another point of view, this is also debatable.

"We have to redefine our curriculum and we have to introduce new aspects to our curriculums, and we should have much more preparations to accommodate gender roles. Departments should have a concern about the gender roles and the stance on the gender" (Field Data, 2021-2022).

State university scholars need to have a clear understanding of the vision and mission of state universities and work towards making that a reality. Sometimes state university curriculums are not well aligned with the demand of the existing systems. Some argue that state universities need to go beyond merely giving thorough academic training. University

curriculums needed to have more insights into gender sensitivity.

"Of course, there are also many academic researches coming from women, and they are doing well. I do not see any difference, any discrimination. So, I believe that now, which represents the discipline that I belong to is generally ok" (Field Data, 2021-2022).

In some instances, the inclusion of female visionary leadership is a matter of the female's own choice. However, most significantly engagement of females in development process of the country is being increased with increasing rates of female higher education. According to the point of view of some respondents, state universities of the country have been making a positive impact by including female visionary leaders who could lead the development process of the country in various ways.

As explained by Greenfield (1986) (Greenfield, 1986 cited in Manasse, 1985: 151), personal and organizational values are significant in visionary Leadership and its crucial in deciding alternative actions (Manasse, 1985: 151). Personal or personalized professional values, personal images of possibilities, and personal assessments of a situation matter in visionary leadership. Visionary leadership is not successful without personal vision and personal commitments, and ultimately it impacts creating organizational excellence. It is important to understand the distinction between managers and leaders. According to Bennis and Nanus (1985) (Bennis and Nanus, 1985: 21 cited in Manasse, 1985: 152), "managers do things right; leaders do the 'right thing'"; therefore, a visionary need to have capacity and capability of making right decisions (Manasse, 1985:152).

"Some of the departments have 90%-80% women. The student population has changed over time when you compare it with the last 15-20 years. So, it has taken a couple of decades. I think now we are in a situation where many departments have at least 50% women. Some departments have, of course, more than 50%" (Field Data, 2021-2022).

According to prospectors, female life expectancy will be higher than males by upcoming years in Sri Lanka. Since the majority of the present state university sector of the country consists of female undergraduates, there is great potential to include female visionary leaders in the development process of the country. This has been further strengthened by increasing rates of females' engagement in many courses of study in state universities.

## VI. CONCLUSION

Sri Lanka shows larger gender gaps in labour force participation in world rankings, although females are nearly half of the population of the country. Although a considerable number of females are engaged in labour force in the country, in most instances bringing female visionary leadership into the mainstream is lacking. Labour force participation in the country contrasts with gender distribution patterns of the state university education system, country's state universities are a cross-section of its society. To sort out future issues of the country, including females in the development process of the country as visionary leaders is much needed. There has to be a balanced approach, integrating interdisciplinary approaches along with life skills, and eliminate gender prejudices. Micro and macro adjustments have to be taken into to consideration to eliminate gendered prejudices, as those prejudices limit females' inclusion as visionary leaders in the development process of the country. Visionary leadership somewhat goes beyond leadership. Visionary leadership does have a long-run vision with clarity, and working towards that in a very pragmatic, strategic way. Females are not genetically less visionary than men. However, in some instances, even females have internalized gendered prejudices against their own selves as somewhat normal. On the other hand, that choice is sometimes influenced by socially constructed gendered prejudices. Patriarchy and gender division of labour have clear negative roots on that. In a context where the state policy of development of the country are not promoting women visionary leadership to navigate development process of the country, it is difficult for women to cope with up challenges they face.

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# Analysing the Economic Impact of Brain Drain and Migration in Sri Lanka

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**Abstract**— Brain drain and migration of professionals has been a topic in Sri Lanka for decades now. But Sri Lankan government haven't taken proper actions to overcome from this issue so far. Migration of skilled professionals showed an increment due to the protest happened recently as it happened to be one of the reasons for the political instability. This paper aims to analyse the brain drain and migration nature in Sri Lanka and identify the key components that determine the skill migration. This study uses a combined methodology, wherein 107 in-depth interviews were conducted to collect data and a systematic review of literature over a period of 22 years (2000-2022). The results show that migration of skilled professionals has been increased up to 2022 and how social, economic, and political factors influenced migration.

**Keywords**— Brain drain, Economy, Migration, Professionals

## I. INTRODUCTION

Recently, migration has been a persistent and ongoing occurrence in Sri Lanka. The major reason for that is the political, economic, and social evolution that has been occurred during the past few years. According to (Reiling, 2018) the term "brain drain" denotes to the international migration of human capital resources, and it mostly refers to the emigration of reasonably educated people from developing to developed countries. Both the term "Brain Drain" and the term "Brain Gain" have been used to describe the movement of skilled workers from developing to developed countries (Gunawardena & Nawaratne, 2017). The reasons why individuals migrate are diverse and ever evolving. The migration of skilled people in a knowledge economy that is globally integrated is caused by more than just the shifting composition of the economy.

In Sri Lankan context, most educated and skilled citizens frequently emigrate, and this trend is not new. The majority of studies on professional migrants worldwide, including those on Sri Lankan migrants, have only looked at those who move to OECD nations (Ekanayake and Amirthalingam, 2021). Many employees prepare themselves deliberately for emigration, specifically those from small island economies like Sri Lanka that lack the scale economies to offer well-paying occupations at home

(Ngoma and Ismail, 2013). Currently, Sri Lanka lacks an appropriate policy framework that motivates experts who have migrated abroad. As a result, it's critical to have laws in place that enable professionals who have worked abroad for a specific amount of time to come back to Sri Lanka (Ume Laila and Farhan Fiaz, 2018).

The purpose of this study is to provide the reader a comprehensive analysis of the factors that increase the brain drain and migration and how that affect to the economy of Sri Lanka. Early research on this topic in a global context concluded that developing countries' human capital was being drained by the movement of their most skilled workers.

## II. OBJECTIVES OF THE STUDY

To analyze the economic impact of brain drain and migration in Sri Lanka, the study identified the below objectives.

- a) To investigate the migration and brain drain nature in Sri Lanka.
- b) To identify the key components that determines the skill migration.

## III. METHODOLOGY AND EXPERIMENTAL DESIGN

In methodology section fundamentally explains a broad analysis of research objectives, research questions and problem statement. In addition to that, it also provides some empirical research studies based on past literature. Past literature reviews provide clear understanding that makes it easier to identify appropriate approaches for data gathering and analysis.

This study has used data collected from more than 100+ executive level professionals in Sri Lankan from 6 sectors namely, IT (Information Technology), marketing, finance, HR (Human Resources) and administration, engineering, and educational in order to analyze the study's key elements.

The sample design of this research study is based on snowball sampling method. The first objective has been analyzed using past literature for the period of 2000-2022 in Sri Lanka. The second objective is analyzed by using

past literature for the same period and data obtained from in-depth interviews. The questionnaire we used for the pilot study changed as per the suggestions given by the interviewer. Then the finalized questionnaire which was used to collect data is a realist one.

The purpose of this in-depth interviews was to collect data on the factors that affect political instability and skill migration. Additionally, to discover more about the participant's experiences and perspectives in related to their roles and responsibilities, challenges they may encounter, and career development opportunities in their respective sectors. The data collected through in-depth interviews are analyzed using thematic analysis. It is utilized for this study because it examines pattern or themes with qualitative data.

#### IV. RESULTS AND DISCUSSION

In this section mainly emphasize on results obtained from past literature review and in-depth interviews. The results of this study's output focus on the nature of skill migration and brain drain in Sri Lanka and the identification of key components of skill migration.

##### A. Objective 1

During the colonial period high-ranking, educated individuals who held administrative positions in Sri Lanka occasionally left the country for employment in other British Empire countries on a small scale. Traditionally most OECD countries like Australia, Canada, New Zealand and United Kingdom have become the most preferred destination of Sri Lankans. The reason for this is that those countries provide citizenship to skill migrants. Through that skill migrants can get many facilities and benefits from those countries (A. Ekanayake & Amirthalingam, 2022).

From 2000, a new wave of migration grew as students migrating for educational purposes. These migrants were those who come from elite or upper-middle-class families or who have received scholarships to migrate. In that time period a number of professionals including engineers, doctors, accountants, managers, technologists and navigators migrated to developed countries in search of higher pay and to provide a better education for their children. In that group clearly provide a brain drain from Sri Lanka (Jayawardena, 2020). According to the Sri Lanka Net Migration Rate (1950 - 2023) statistics, in the year 2000, net migration rate was - 4.87 per 1000 population. It declined 1.20% from 1999. Between 2000-2004 the migration population has not changed significantly. Then the 2005, net migration rate was -4.906 per 1000 population and it was decline 2.23% from 2004. (Jayawardena, 2020).

Sri Lanka has shown increase until 2010 in the number of skill migrants between 2009 to 2012. The Middle East countries increased labor migration at a faster rate is the cause of this sudden rise. After 2010 the unemployment rate decreased again until 2012, due to the increase in overseas job opportunities. Accordingly there was an increase in the migration population as well (Dharmadasa and Dissanayake, 2018).

In 2012 - 2013, with the increase in unemployment rate in Sri Lanka, the number of migrants also increased during that period. (Gunawardena & Nawaratne, 2017).

Also, 2014 plays a significant role when discussing the population that has migrated. That time period had the largest population migration in Sri Lankan history. The number is given as 300413. It was more than double of the migrated population of in the previous year after 2014 (Wijesinghe & Jayawardane, 2021).

The net migration rate of 2020 was -4.390 per 1000 population and its decline 2.68% from year 2019. In 2022 Sri Lanka saw 311,269 people leaving from the country and that is the highest in the history. This exceed the previous record of 300703 in 2014 (Sri Lanka Net Migration Rate 1950 - 2023). There are many Sri Lankan Skilled professional have migrated permanently to different countries such as Australia, New Zealand, Canada, United Kingdom, Western Europe and United States of America during recent years. (Dharmadasa and Dissanayake, 2018).

The below table listed the net migration rate and the related growth rate from 2000- 2022.

Table 1. The Net migration rate and the related growth rate (2000- 2022)

Year	Net Migration rate	Growth rate
2000	-4.87	-1.20%
2001	-4.81	-1.23%
2002	-4.751	-1.23%
2003	-4.692	-1.24%
2004	-4.799	2.28%
2005	-4.906	2.23%
2006	-5.012	2.16%
2007	-5.119	2.13%
2008	-5.226	2.09%
2009	-5.123	-1.97%

2010	-5.02	-2.01%
2011	-4.916	-2.07%
2012	-4.813	-2.10%
2013	-4.71	-2.14%
2014	-4.694	-0.34%
2015	-4.678	-0.34%
2016	-4.663	-0.32%
2017	-4.647	-0.34%
2018	-4.631	-0.34%
2019	-4.511	2.59%
2020	-4.39	-2.68%
2021	-4.27	-2.73%
2022	-4.149	-2.83%

Source: Macrotrends website (Per 10000 Population)

### B. Objective 2

Skill individuals are one of the essential resources for every country. Migrating Skill professionals from their home country to another developed country directly impacts the development of the country. Many educated people will be influenced to migrate to developed countries as they are often unable to provide what they need in their home country (Ullah, 2018).

Many professionals including engineers, technologists, navigators, and doctors migrate to developing countries in the year 2000 to increase their income and to provide better education for their children. During that time Australia, Canada, New Zealand and the USA releasing few immigration restrictions as well. (Jayawardena, 2020).

The income gap between their home country and the host country is one of the factors that influence skilled professionals to migrate on their own. A country with a good income for their ability will be inclined to choose a country as their destination. This is mostly common in low income countries (Gunawardena and Nawaratne, 2017). Push factors are the factors that drive away people from their home country. Major push factors of Sri Lankan skill professionals migrate to other countries are existing political influence, poor working conditions, corruption in the country, less income and Lack of job satisfaction. Majority of Sri Lankan professionals migrate to another countries to get the better opportunities for employment, higher living standards and higher wages (Wijesinghe and Jayawardane, 2021).

According to studies on the migration of Sri Lankan professionals to the OECD, there are variety of pull and push factors that encourage skilled professionals to migrate to the OECD countries. In addition to that they identified, lack of opportunities for professional development, better working conditions, higher quality of life, and lack of better educational opportunities available for their children are the major pull and push factors to influence professionals to migrate to another country (Ekanayake and Amirthalingam, 2021).

There are two different patterns of migration that affect Sri Lankan people. The first one is the Skill professionals permanently migrate to developed countries. Second one is the semiprofessionals or nonprofessionals migrate temporary to the gulf countries like Kuwait, Qatar and etc. In this situation most of the permeant migrants expect to get a higher living standard and get a job that suits their skills and to get a better salary (Dharmadasa and Dissanayake, 2018). Many skilled professionals are trying to migrate to developed countries due to the pay gap between professionals in Sri Lanka and other countries. This will inspire many to migrate to get proper value for their qualifications and skills as well to ensure their financial security. (Weeraratne, 2018).

#### 1) Demographic information of respondents

All the responses received were compiled in such a way that the results represented all of Sri Lanka's provinces. The majority of respondents were received from western provinces (59%). Lowest number of responses were received from North-Eastern province (1%). In relation to percentages 15% of responses have been garnered from the Central province, 8% from the Southern province, 3% from the Eastern and Uva provinces and 4% from the North Central, North-Western and Sabaragamuwa provinces.

53% of the responses were received from male executives while 47% of the responses were from female executives. The age group between 20-30 has given the highest number of respondents (49%) and the age group between 51-60 has received the lowest responses (1%). 42% of responses were received from the age group between 31 - 40. Only 9% of Executives between the ages of 41 -50 have responded. From the sectors, we collected data; IT sector has acquired the majority of the responses. In percentage wise, it is 32%. Construction sector has given the least number of responses and it is 1%. Moreover, 11% of the responses were received from HR and administration, 17% from finance, 11% from banking, 6% from engineering and educational sectors.

According to the highest education qualification, 5% of the executive level employees are degree holders. 27% of employees have acquired master qualification and 8% of respondents have diploma qualification

We gathered responses from people with more than 3 years of working experiences. From those responses, 40% of executives have 1-5 years of working experiences. 31% of them have 6-10 of working experiences, 19% of them have 11-15 years of working experiences, 6% of them have 16-20 years of working experiences, and only 4% of executives have more than 20 years working experiences.

## 2) *Impact on economy through skill migration.*

### a. *Current job satisfaction.*

Through our in depth interviews we collected data in the executives' perceptions of their current job satisfaction. As a result, the responses they provided are shown below.

"Not 100% but to a certain extent satisfied about my current job"[Education sector employee]

"Not at all, because I think there are some inconsistencies between the qualifications and my job" [Finance sector employee].

"No, according to my education qualifications, I am not that much satisfied with my current job" [Engineering sector employee].

"Yes I am satisfied when considering my educational qualifications. But due to the recent tax policy changes and economic recession the salary I receive is not enough" [IT sector employee].

To identify the push and pull factors that influence Sri Lankan young engineers to migrate to Australia, Wijesinghe and Jayawardane., (2021), have conducted a 5-point Likert-type online questionnaire to 63 engineers who are living in Australia. According to that questionnaire, they have discovered lack of job satisfaction is one of the significant factors that inspire young engineers to migrate to Australia. As a percentage, it is 47.6%. They have also indicated that if any person's job satisfaction is in low level, that there is possibility of leaving the job or that person work with low efficiency.

Munoz et al., (2021), have stated that the tendency to migrate depends on the desire for job satisfaction.

To evaluate the factors affecting the migration, Asadi et al., (2018), have carried out 21 semi structured interviews between 2015 and 2016. They have identified job dissatisfaction with salary and job dissatisfaction with the

behavior of higher officials influence professionals to migrate.

By considering the above provided responses and past literature data as proofs, it appears that many people are dissatisfied with their current employment situation, and this "Job dissatisfaction" can be mentioned as one factor that affects many skilled people to migrate.

### b. *Intention to migrate*

Below are the responses to the question of whether executives would be willing to migrate.

"Yes. have intention to migrate now" [HR sector employee].

"Yes, these days i am planning to move for another country" [Marketing sector employee].

According to the above respondents majority of executive level employees in Sri Lanka, they have willingness and intention to migrate to developed countries.

Popogbe and Adeosun, (2022), have carried out there is a no connection between the rise in exit or migration intentions and other indices. These include the nation's poor health, high unemployment, rising poverty rate and insecurity.

According to Dako-Gyeke, (2016), the intention to migrate is define as the sum of exepcted utilities, which are catogarized according to the aspects of wealth, status, comfort, suggetion, autonomy, affiliation, and morality. And alos one could argue that the prospect of employment in a destination country is a key factor in youth migration intentions, which is based on individual or family decisions.

### c. *Reasons to migrate*

There are many reasons that influence Sri Lankan executives to migrate to another country. As a results, the responses they provided are shown below.

"I am not a fan of Sri Lankan culture, which is why I would like to migrate" [IT sector employee].

"I like to get more professional experience and experience the world class professionalism" [Marketing sector employee].

"The main reason is there is no proper law in this country and no democracy in this country" [IT sector employee].

According to the Asadi et al., (2018), they have identified work place problems, discrimination between fields, to



gaining the new experiences and to achieving a better life are the major factors that affecting to migration.

Grabowska and Jastrzebowska., (2023), have stated that, limited job opportunities, low salaries and to obtain better job and life satisfaction.

In addition to that Ekanayake and Amirthalingam, (2021), have identified better working conditions, lack of opportunities for professional development, higher quality of life, and better educational opportunities available for their children are the major pull and push factors to influence professionals to migrate to another country. Therefore it can be stated that majority of skilled people migrate mostly due to some common set of factors.

#### *d. Perception of current government*

According to the perception of current government and procedures, Sri Lankan executives have negative, positive and mixed feeling perceptions as well. Those results are shown below.

"This is not an acceptable government, They have no clear plan and process" [Marketing sector employee].

"Highly dissatisfied about the current government procedures" [Banking sector employee].

"To emerge from the current economic crisis and improve long term prospects, SL needs to enhance fiscal and debt sustainability and implement growth enhancing structure reforms. These measures need to be accompanied by tighter and more consistent monetary policy to contain inflationary pressure" [Finance sector].

Docquier et al., (2007), observed that brain drain increases with political instability country and degree of fractionalization in the country of origin and decrease with residents human capital, which indicates that average emigration rates are high in political unstable countries.

Furthermore, researchers had found that, for the migrants, economic prosperity and political stability would be the attractive factors to be considered when migrating to the developed regions (Tataru, 2020).

Therefore, when people cannot be met their requirements in a politically unrest country, there is a high tendency for those who have the ability and talent to migrate to developed countries. As a recent incident in Sri Lanka, according to the, Sri Lanka Net Migration Rate, (1950 - 2023), data, in 2022 Sri Lanka saw 311,269 people leaving from the country and that is the highest in the history. The year 2022 can be considered as a period of political instability in Sri Lanka.

#### *e. Problems due to political instability*

The following responses were made by executives regarding the grant issues brought on by political instability in Sri Lanka.

"Limited career growth opportunities, lack of investment in technology infrastructure, and uncertainty in the business environment highly affecting to the IT industry" [IT sector employee].

"Salary is too low with other expenses and inflation of the country" [Finance sector employee].

"Always have to work with sudden changes, It often creates unnecessary stress in our lives" [Banking sector employee].

According to their 5- point likert scale responses, Wijesinghe and Jayawardane, (2021), have identified majority of Sri Lankan engineers have agreed that the country's current political unrest is the reason to that they migrated to Australia. Out of 63 responses 37% of people strongly agreed with it.

Accordingly, common issues like, job insecurity and inflation are frequently faced by the general population in politically unstable countries.

#### *f. Tax policy changes*

The recent tax policy change has been mainly affected to the executives in Sri Lanka. Accordingly, when getting their opinions about it, many of the following answers were given.

"The recent tax policy changes have impacted the overall business environment and may affect the IT industry in terms of investment and growth as well" [IT sector employee].

"Not acceptable. Govt. is putting pressure on people for the offences committed by them" [Marketing sector employee].

"Very disappointed. The government imposed tax at a difficult time for the people. It is difficult to live when the tax is deducted from the salary along with inflation" [Banking sector employee].

According to the Ekanayake and Amirthalingam, (2021), have stated that the main reason for migrating to Gulf countries across OECD countries is the tax-free salary, which respondents believe is higher than disposable income in OECD countries.

Huber et al., (2010), have identified that different subgroups of highly skilled migrants will be drawn to countries for various reasons, such as tax and social security arrangements that can act as barriers to high-skilled migration. Every country ought to impose taxes in its citizens. However, if taxes rise in the country, wages should also increase to some extent, because otherwise every individual would move out of that location (Kleven et al., 2020).

#### *g. Brain gain*

Below are the responses given by the executive level employees to the question of "Is there way to turn brain drain into brain gain in Sri Lanka".

"Yes, it may happen if sri lankan government establish stable policies" [Banking sector employee].

"As I think it's not about getting them back - it's about earning their trust on investing in Sri Lanka, as I know may abroad don't expect Sri Lanka to be tiptop perfect in politics, but government policies need to be somewhat standardized for them to consider coming back" [Hr and admin sector employee].

"Need creat an environment where right people have the right jobs and duties" [Finance sector employee].

Nguyen, (2006), has emphasized many less developed countries complain that they suffer from the "brain drain" that occurs when skilled workers are sent to a developed nation for additional training but do not return home country. According to the (Robertson, 2006), has identified, without counting students, the Us census demonstrated that there were more than 2.5 million highly educated immigrants from developing nations who resided in the United States alone.

When comparing the facilities between their home country and the developed country they migrated to, the majority of people who migrate frequently attempt to reside in the country with a higher living quality.

#### *h. Changes to be carried out*

Below are the relevant responses regarding the changes that should take place in Sri Lanka's political structure.

"I think new strong leadership make sri lanka as a inhouse production hub for all products starting from pencil" [Marketing sector employee].

"Theft, corruption and fraud should be stopped completely and we should make maximum use of the available resources" [IT sector employee].

"I believe there should be reforms to improve governance, transparency, and accountability" [Education sector employee].

Laila and Fiaz, (2018), have suggested that government should support infrastructure, life securities and provide comforts of life especially for rural areas. To overcome the issue of brain drain it should also be possible to give job opportunities and other financial incentives.

## V. CONCLUSION

Migration of educated and skilled individuals to developed countries is a mainly discussed issue in Asian countries. The purpose of this study is to examine the impact of economy caused by migration and brain drain in Sri Lanka. In order to achieve this target, the data and findings related to the 2 objectives of the previous chapter have been revealed. The results of the study are in line with in-depth interviews and past literature from 2000 – 2022. The main limitation of this study is limited data availability. In addition to that this research study only focuses on the executive level employees in Sri Lanka who have more than 3 years of experiences. As well as this research only considers the executive level professionals in few sectors.

Future researchers might examine the influence on Sri Lanka's economy by taking into account more factors and findings of this research will continue to generate future debates on this research topic

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# Study on How Technological Development and Digital Transformation are Applied in Social Organizations in Transforming Themselves to Gain Efficiency and Leadership Competency

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**Abstract**— This study explores the application of technological development and digital transformation in social organizations, focusing on their transformative potential in achieving efficiency and leadership competency. The research investigates how social organizations leverage technological advancements to enhance their operations, decision-making processes, and overall effectiveness. Through a comprehensive analysis of existing literature and primary data that collected through structured interviews form a non-random sample of 38, this study has aimed to address the strategies, challenges, and outcomes associated with implementing technology-driven transformations in social organizations. The main objective of the study is to examine how technological development and digital transformation are applied in social organizations to enhance their efficiency and gain leadership competency. The findings provide valuable insights into the multifaceted nature of digital transformation, including its impact on organizational efficiency and leadership competency. By understanding the dynamics of technological development and its role in the context of social organizations, this study contributes to the existing body of knowledge and provides practical implications for stakeholders involved in driving organizational change

**Keywords**— Technological development, digital transformation, social organizations, efficiency, leadership competency, technology-driven transformations, organizational change.

## I. INTRODUCTION

Social organizations, such as advocacy groups, NGOs, and community organizations, are formed to address social issues and humanitarian objectives. These organizations rely on member support, volunteerism, donations, and government grants to achieve their goals. In contemporary management discourse, digitization, digitalization, and digital transformation are considered important objectives (Hesse, 2015; Avis, 2018). Digitization involves converting analog information into digital formats, while digitalization refers to the reorganization of social life around digital communication and media infrastructures. Digital transformation encompasses the use of digital

technologies to improve organizational features and bring about major changes (Parida et al., 2019; Avis, 2018).

Social organizations are undergoing digital transformations to enhance their efficiency, connect with supporters, raise funds online, access data, and use analytics for decision-making (Porter & Heppelmann, 2015). Effective leadership is crucial in driving successful digital transformations by anticipating change, creating a vision, mobilizing support, and implementing structures that promote desired behaviors. Digital transformation revolutionizes businesses, transforming their products, operations, and value creation pathways. It requires comprehensive initiatives that encompass changes in strategy, culture, structure, procedures, and business models (Earley, 2014). Digital transformation also creates opportunities for social organizations to empower marginalized groups, enhance inclusivity, and foster innovation. Technology development and the digital era improve the efficiency and capabilities of social organizations (Warner & Wager, 2019).

Digital tools, automation, cloud computing, and social media play significant roles in streamlining operations, data management, fundraising, and communication. However, challenges exist in implementing digital transformation, particularly in developing nations where cost is a concern (Di Maio, 2014). Understanding the sociotechnical system theory and optimizing social and technical systems are important for successful digital transformations in organizations. Digital technologies, such as the internet of things, cloud computing, artificial intelligence, and big data, are driving the shift towards digitalization in businesses (Earley, 2014). While the terms "digital transformation" and "digitalization" are often used interchangeably, digital transformation refers to broader organizational changes, while digitalization focuses on business models and digital components of products and services decisions (Porter & Heppelmann, 2015; Autio et al., 2018).

Academics have studied digital transformation in businesses, focusing on its key components. According to previous research, a digital transformation strategy consists

of four essential elements: technology adoption, changes in value generation, structural changes, and financial concerns. Creating specialized digital transformation units within companies can help develop efficient strategies by facilitating governance and collaboration (Hesse, 2018).

However, most studies have focused on how digital transformation is being implemented in established companies. Researchers have identified nine major obstacles that firms must overcome when transitioning to a digital business model, including the lack of tools and concepts for digitization, unclear migration scenarios, organizational and management challenges, problems with the organizational structure, limited cooperation and collaboration, resource limitations, low awareness, unsupportive culture, and lack of competencies. Overcoming these obstacles is crucial for effective digital transformation.

The linkages between digital innovation, business model innovation, and the development of dynamic capabilities for digital transformation have been emphasized. Empirical investigations are needed to understand the actual processes companies go through during their digital transformation journeys.

The increasing dependence on digital products and services by individuals, businesses, and society has brought significant changes to enterprises. Examples like Uber, Facebook, Alibaba, and Airbnb demonstrate the disruptive potential of digitalization. Traditional business models may require re-evaluation in light of the digital economy's future implications, and industry arrangements may face significant transformations or pressure (Avis, 2018). The digital world presents opportunities for emerging niche players while also leading to a winner-take-all effect. Businesses need to disrupt their own strategies, leverage new digital technologies, and adapt to changing customer preferences and employee behaviors (Hesse, 2015). Understanding the digital value chain, focusing on the customer, adapting to employee attitudes, utilizing modern communication and collaboration methods, and recognizing opportunities in both B2C and B2B markets are crucial. Neglecting digital developments can lead to the downfall of well-established companies (Warner & Wager, 2019).

The research problem at hand pertains to the limited comprehension and empirical evidence surrounding the implementation of technological advancements and digital transformation within social organizations. Consequently, there is a pressing need to explore and comprehend the strategies, impacts, and barriers associated with the adoption of technology and digital transformation within social organizations. By addressing this issue, the study

aims to offer useful ideas and insights to social organizations who want to use technology to improve their organizations and perform better.

The main objective of the study is “to examine how technological development and digital transformation are applied in social organizations to enhance their efficiency and gain leadership competency”. The specific objectives are to explore the current technological landscape in social organizations and identify the key technological advancements and digital transformation strategies being implemented, to assess the impact of technological development and digital transformation on the operational efficiency of social organizations, to examine the role of technological innovation in enhancing the leadership competency of social organizations, to identify the challenges and barriers faced by social organizations in adopting and implementing technological solutions for transformation, to provide recommendations and best practices for social organizations to effectively leverage technological development and digital transformation to enhance their efficiency and leadership competency, to contribute to the existing body of knowledge on the application of technology in social organizations and its implications for their overall performance and social impact.

## II. LITERATURE REVIEW

In recent times, the strategic progression of organizations across various sectors has been significantly influenced by the advancement of technology and the process of digital transformation. This review of literature intends to investigate the utilization of these advancements within social organizations, aiming to trigger substantial modifications that result in improved operational efficiency and more effective leadership capabilities. As articulated by Brynjolfsson and McAfee (2014), technological development encompasses the gradual evolution and assimilation of diverse digital tools, while digital transformation involves a comprehensive overhaul of processes to effectively harness these tools. Within the realm of social organizations, which encompass entities like non-profits, NGOs, and community-focused groups, the need to optimize efficiency while concurrently nurturing robust leadership proficiencies is especially emphasized. Academic experts such as Avgerou (2018) and Westerman et al. (2014) describe the potential impact of technologies such as cloud computing, data analytics, and artificial intelligence in simplifying operations and amplifying decision-making procedures. Moreover, they draw attention to the capacity of these innovations to enhance leadership acumen through mechanisms such as real-time insights provision, collaborative facilitation, and the enabling of data-driven strategic adaptations.

It has become evident that in today's digital age, social organizations must embrace technological advancements and undertake digital transformation initiatives to stay competitive and relevant. The review has highlighted several ways in which technological development can enhance efficiency within social organizations, including process streamlining and resource optimization. Furthermore, it has emphasized the crucial role of leadership competency in driving and managing digital transformation, emphasizing the need for leaders to possess skills such as digital literacy, strategic thinking, adaptability, and change management. By analyzing case studies and examples, this review has provided valuable insights into successful implementations of technology and digital transformation in social organizations, while acknowledging the associated challenges. The previous research findings describes the importance of aligning technology initiatives with organizational goals and strategies, as well as fostering a supportive culture that embraces innovation and change. Looking ahead, it is recommended that social organizations proactively invest in technological development and digital transformation, taking into account the unique characteristics and needs of their respective sectors. Leaders within these organizations should prioritize the development of necessary competencies to navigate the digital landscape effectively and guide their teams through transformative change. Collaborative efforts between social organizations, research institutions, and technology providers can facilitate knowledge sharing and the adoption of best practices. In summary, this literature review contributes to the understanding of how social organizations can leverage technological development and digital transformation to enhance efficiency and leadership competency

#### IV. METHODOLOGY

The sample for the study on how technological development and digital transformation are applied in social organizations to gain efficiency and leadership competency using semi-structured interviews consisted of individuals who have direct involvement or expertise in technology adoption and digital transformation initiatives within social organizations. The research population had through the pilot research population of the study was 42 and it was decided to relate the population of the pilot sample to be met as the sample of the study population and decide the size of the sample according to the formula by Cochran (1977) and the final sample size of 38 participants (n=38) provided a sufficient depth and breadth of information for mex method research studies.

Semi-structured interviews and Likert scale questionnaires have been conducted for collecting primary data and secondary data was collected through multiple resources, including scholarly publications, business analyses, tautest reports, internet articles, and case studies of social

organizations that have successfully adopted technological advancement and the digital revolution. To analyse qualitative data, it is used thematic analysis as one the qualitative data analysis technique to achieve research objectives. The generated themes will support to achieve the objectives. The researcher employed SPSS to generate charts. Microsoft Excel, on the other hand for data management and analysis. The research was following a deductive method in process.

#### V. RESULTS

##### *i. Technological Development and Digital Transformation Initiatives of the Social Organizations*

The research findings suggest that social organizations have made significant progress in technological development and digital transformation initiatives. The majority of respondents rated their level of technological development as moderate, high, or very high according to Likert scale. In terms of digital transformation, most organizations had undergone partial transformation, while a smaller percentage reported complete transformation, and a few had not undergone any transformation. Cloud computing emerged as the most implemented digital technology among social organizations, followed by the Internet of Things (Imran et al., 2018; Hallikainen et al., 2017; Warner & Wager, 2019)

Artificial intelligence and big data analytics were implemented to a lesser extent, although some organizations mentioned using combinations of these technologies. The timelines for implementing technological development and digital transformation initiatives varied, with a duration of 10 years being the most commonly mentioned. The motivations for adopting these initiatives were diverse. Efficiency and effectiveness, cost reduction, and gaining a competitive advantage were among the most common motivations. Other motivations included adapting to global shifts, improving decision-making processes, simplifying tasks, and responding to the effects of the COVID-19 pandemic. Overall, the research highlights the progress made by social organizations in embracing technological innovation and digital transformation. While there is a range of advancements across different organizations, the majority perceive their level of advancement as moderate to high. Cloud computing and the Internet of Things are prevalent technologies, while artificial intelligence and big data analytics are less widely implemented. The motivations for adoption encompass various goals, from improving efficiency to adapting to changing circumstances and reducing costs (Autio et al., 2018; Imran et al., 2018; Hallikainen et al., 2017).

## *ii. Level of Technological Development and Digital Transformation*

The data indicates that social organizations have recognized the importance of technological development and digital transformation initiatives in driving positive changes and improvements. Comprehensive training and upskilling programs were identified as a priority, highlighting the organizations' commitment to equipping their workforce with the necessary skills to adapt to digital technologies and processes. Developing a clear digital transformation strategy and establishing effective change management procedures were also considered crucial, emphasizing the value of strategic planning and efficient management of organizational change. A portion of respondents mentioned the employment of technology consultants or professionals, indicating the organizations' willingness to seek external expertise to support their digital transformation efforts. Some respondents mentioned combinations of measures, including comprehensive training, strategy development, and change management processes, demonstrating an understanding of the interconnected nature of these initiatives. The impact of technological development and digital transformation on efficiency and productivity was evident from the responses. Positive changes included better data availability and utilization, quicker and informed decision-making, enhanced productivity, reduced paperwork, improved communication and collaboration, and increased trust among stakeholders. However, a small proportion of respondents did not observe any changes, and a few responses were unclear or ambiguous. In conclusion, the data emphasizes the significance of investing in comprehensive training, strategic planning, change management, and external expertise to drive successful digital transformation in social organizations.

## *iii. Drivers and Motivations for Technological Development and Digital Transformation*

The data reveals that the primary driver for technological development and digital transformation in the surveyed social organizations is improved efficiency, as indicated by the majority of respondents (71.1%). This suggests that organizations prioritize using technology to streamline processes, increase productivity, and achieve better outcomes. Cost reduction was also recognized as a significant motivation, selected by 13.2% of respondents, indicating an awareness of technology's potential to optimize resource allocation and reduce operational expenses. Enhanced leadership competency was chosen as the primary driver by 15.8% of respondents, highlighting the acknowledgment that technology can equip leaders with the necessary tools and insights to make informed decisions and drive organizational success. Other

motivations mentioned include gaining a competitive edge, improving communication with donors, accessing information easily, organizational development and survival, and meeting emerging needs. These motivations demonstrate the multifaceted benefits organizations expect to attain through technological development and digital transformation. Overall, the findings emphasize the importance of leveraging technology to improve efficiency, reduce costs, enhance leadership capabilities, and address various organizational needs in social organizations.

## *iv. Efficiency and Operational Impact*

The data provides several important insights into the impact of technological development, challenges faced during digital transformation, and changes in company culture within social organizations. Technological development has significantly contributed to the efficiency of social organizations, according to 42.1% of respondents. This includes improved data management and analysis, streamlined processes and workflows, and enhanced communication and collaboration. Integration issues with existing systems and resistance from employees were identified as prominent challenges during digital transformation, along with limited financial resources and a lack of technological expertise. Overcoming these challenges requires careful planning, change management strategies, training, and adequate resources.

Digital transformation has had a notable impact on company culture, as mentioned by 39.5% of respondents. It has fostered an innovative and adaptable culture, enhanced employee engagement and satisfaction, and increased collaboration and teamwork. These impacts highlight the positive influence of digital technologies on employee motivation, creativity, and collaboration within the organization. In terms of specific impacts on operational processes, 44.7% of respondents mentioned that technological development and digital transformation streamline processes and workflows within social organizations, resulting in increased efficiency. Additionally, 26.3% of respondents highlighted that technological development and digital transformation reduce the need for human resources, indicating the potential of automation and digital tools to automate tasks and reduce reliance on manual labor. Furthermore, 13.2% of respondents mentioned that technology reduces miscommunication with stakeholders, facilitating effective communication and information sharing. Another 13.2% of respondents noted that technology adoption reduces costs and overheads by streamlining operations and eliminating manual processes. Overall, the data emphasizes the positive impact of technological development and digital transformation on the efficiency, communication, collaboration, and culture within social organizations. It



also highlights the challenges faced during the digital transformation process and the need for careful planning and resources to overcome them successfully.

#### *v. Leadership Competency and Organizational Impact*

The data indicates that digital transformation has significantly impacted leadership competency within social organizations. According to 36.8% of survey participants, leadership across the board has been affected by the digital transition. Improved strategic planning capabilities (23.7%) have emerged as a critical factor in enhancing leadership competency. Leaders now have the skills and resources to enhance strategic planning, make informed decisions, and establish practical corporate objectives. Improved decision-making processes (18.4%) have also been highlighted, with digital transformation providing leaders access to real-time data, advanced analytics, and predictive modeling for data-driven decision-making. Additionally, digital transformation has increased adaptability to change (7.9%), enabling leaders to respond effectively to rapidly changing environments, embrace innovation, and navigate complex challenges.

Increased adaptability to change (13.2%) was mentioned as another significant impact on leadership competency, fostering a mindset of flexibility, resilience, and the ability to drive change within the organization. The data suggests that digital transformation has significantly influenced leadership competency by enhancing strategic planning capabilities, improving decision-making processes, and increasing adaptability to change. These impacts contribute to developing agile and effective leaders who can guide their organizations through digital transformation and succeed in a rapidly evolving environment. The data also reveals that leadership plays a crucial role in driving technological advancement and digital transformation. According to 42.1% of respondents, leadership influences these areas. Distribution of funds for technological investments (13.2%) emerged as an important leadership function, requiring leaders to secure and allocate the appropriate financial and human resources to support technology investments. Encouraging innovation and risk-taking (10.5%) was highlighted, emphasizing the importance of leaders fostering a culture of innovation and inspiring teams to explore new technologies and drive transformation. Vision-setting and strategic planning (21.1%) were identified as crucial leadership functions, enabling leaders to align technical development activities with the organization's goals and objectives. Some respondents mentioned positions that combined these leadership functions.

#### *vi. Role of Leadership in driving technological development and digital transformation*

The provided data highlights the impact of technological development and digital transformation on leadership competency within organizations. It reveals that technology has positively influenced decision-making processes, efficiency, and communication within leadership roles. Leaders have adapted their behavior, prioritized learning and adaptation, and embraced technology to drive organizational success. While some respondents reported no significant changes in organizational structure or leadership roles, others mentioned adjustments such as reduced personnel or changed job descriptions. The data indicates that digital transformation has made it easier for executives to access real-time data and advanced analytics, leading to more efficient and data-driven decision-making. It has also fostered a mindset of flexibility and resilience among leaders, enabling them to navigate complex challenges and embrace innovation. A significant proportion of respondents (36.8%) believed that digital transformation has had a comprehensive impact on leadership competency across various aspects, indicating its significant influence on leadership within social organizations. When examining the role of leadership in driving digital transformation, respondents highlighted the importance of leaders securing and allocating necessary resources to support technology investments (13.2%). They also emphasized the role of leaders in fostering a culture of innovation, experimentation, and risk-taking (10.5%) to inspire teams and drive digital transformation. Additionally, leaders were seen as providing a clear vision and strategic direction for technological development efforts (21.1%), aligning them with overall organizational goals. Some responses mentioned a combination of roles, highlighting the multifaceted nature of leadership's role in driving technological development and digital transformation. Efficiency was a common theme associated with leadership competency, including aspects such as effectiveness, productivity, and resource optimization. Leadership competency itself was described as a set of skills and behaviors that contribute to superior performance, encompassing adaptability, vision, clear communication, integrity, teamwork, conflict management, and meeting global standards.

#### *vii. Impact on Stakeholder Relationships and Beneficiaries and Security and Privacy in the Digital Transformation Process*

The implementation of digital technologies in social organizations has brought positive impacts in various areas. Firstly, it has improved the accessibility of services and resources for recipients, making them more readily available. Secondly, the adoption of digital technologies

has increased transparency and accountability within these organizations, fostering trust and accountability through greater transparency in operations and decision-making. The integration of digital technologies has also positively affected social organizations' relationships with clients and stakeholders. It has enhanced communication, engagement, and openness, leading to stronger bonds and successful collaborations. Organizations have taken measures to ensure data security and privacy, including complying with regulations, conducting regular data audits, and implementing robust cybersecurity measures. These measures aim to protect sensitive information, address vulnerabilities, and safeguard digital systems and networks from unauthorized access and cyber threats. The data emphasizes the significant positive changes brought about by the implementation of digital technologies in social organizations, benefiting both the organizations themselves and their clients/stakeholders. By employing a combination of measures such as compliance, data audits, and cybersecurity practices, organizations strive to mitigate risks, protect data, and maintain trust and confidence among their stakeholders. It is crucial for organizations to continuously update and adapt their security measures to stay ahead of evolving threats and technologies in the digital landscape.

## VI. DISCUSSION

### A. Adoption and Integration of Technology

To successfully adopt and integrate technology, social organizations need a clear implementation strategy that includes stakeholder identification, timeline establishment, expectation management, and efficient resource allocation. Common challenges in this process include resistance to change, lack of technical expertise, financial constraints, and data security concerns. Overcoming these challenges requires change management strategies, investment in training and capacity building, and addressing security and privacy issues. Cultivating a technology-driven culture, promoting a learning environment, and providing support and training to employees are crucial for successful technology adoption and integration. The benefits of technology adoption and integration in social organizations include increased operational efficiency, task automation, improved data management and analysis, enhanced communication and collaboration, and empowering employees to make data-driven decisions. Technology integration also enables organizations to adapt to change, tackle challenges, and enhance leadership competency through strategic decision-making. In conclusion, effectively incorporating technology into social organizations is essential for improving efficiency and leadership competency. By understanding the strategies, challenges, and outcomes associated with technology adoption and integration, social organizations can leverage

technological advancements to transform themselves and achieve their goals in the rapidly evolving digital landscape.

### B. Transformational Impact on Efficiency

This work explores how technological advancements and digital transformation enhance efficiency in social organizations. Techniques such as resource optimization, automation, and expedited procedures improve decision-making, reduce costs, and increase productivity. Automation, powered by AI and machine learning, replaces manual tasks, minimizes errors, and boosts productivity. Digital transformation optimizes resource allocation through data analytics and reporting tools, leading to cost savings and improved resource utilization. Digital tools facilitate collaboration and communication, resulting in smoother workflows and faster decision-making. Data-driven decision-making using gathered and analyzed data enhances resource management and productivity. Technological advancements and digital transformation create agile and responsive environments, enabling organizations to adapt quickly and meet stakeholders' evolving needs. These transformations significantly enhance efficiency, overall performance, and competitiveness in the digital age.

### C. Leadership Competency and Skills Development

Effective leaders in Sri Lankan social organizations understand the potential of technology and actively embrace digital initiatives. They provide visionary guidance, set clear goals, and motivate their teams to adapt to technological changes, fostering innovation and increased efficiency. These leaders also develop their own digital skills and knowledge to competently lead in the digital era. They understand emerging technologies, data analytics, cybersecurity, and digital marketing, enabling them to guide and facilitate change within their organizations. Additionally, effective leaders recognize the importance of developing digital skills across their organizations. They invest in training and capacity-building initiatives to upskill their staff, fostering a culture of continuous learning and confident adaptation to technological changes. Sri Lankan leaders also address unique challenges such as limited digital infrastructure, the digital divide, and varying levels of digital literacy. They bridge these gaps by collaborating with stakeholders, forming public-private partnerships, and advocating for policies that promote digital inclusion and accessibility. In conclusion, equipped with digital skills and a forward-thinking mindset, effective leaders drive digital initiatives, foster innovation, and promote continuous learning in Sri Lankan social organizations. By investing in skills development and addressing contextual challenges, leaders

enhance efficiency, leadership competency, and maintain a competitive edge in the digital landscape.

#### *D. Organizational Culture and Change*

Leaders play a crucial role in fostering a culture that embraces change and digital transformation. They articulate a vision, inspire employees to take risks and experiment, and create a supportive environment. Organizational culture should promote a learning mindset, digital literacy, training programs, and collaboration to support technology adoption. A flexible and agile culture that values continuous improvement is necessary for sustained digital transformation and leadership competency. Effective change management practices, including clear guidance and addressing resistance, are vital for a smooth transition. By fostering an inclusive environment, leaders empower employees and ensure organizational agility and competitiveness. In conclusion, a culture of innovation, learning, and flexibility is essential for enhancing leadership skills and efficiency in the context of digital transformation. Effective leadership drives change and ensures organizational competitiveness in the digital era.

#### *E. Ethical Considerations and Social Impact*

Ethical considerations in technology adoption by social organizations encompass data privacy, security, transparency, fairness, and accountability. Organizations must prioritize individual privacy, handle sensitive data responsibly, and comply with legal requirements. They should assess the social impact of technology, considering stakeholders and addressing societal challenges. Ethical use of automation and AI involves transparency, fairness, and avoiding bias and discrimination. Organizations should practice responsible digital citizenship, bridging the digital divide and promoting inclusivity. Clear ethical guidelines and governance frameworks can guide digital transformation, while regular audits mitigate risks. By addressing ethical challenges, organizations can transform themselves, enhance efficiency, promote leadership competency, and contribute to societal well-being.

### VII. CONCLUSION

This study explores the utilization of technology and digital transformation in social organizations to enhance efficiency and leadership competency. It covers various themes including technology adoption, impact on efficiency, leadership development, organizational culture, change management, and ethical considerations. The findings highlight the role of technology in improving operational efficiency and resource allocation. Effective leadership and the development of digital skills are crucial for successful technology implementation. Organizational

culture and change management play a critical role in embracing technology and driving innovation. Ethical considerations and social impact must be addressed to ensure responsible and inclusive technology use. The study provides valuable insights and recommendations for social organizations looking to leverage technology for growth and success in the digital era. The study found that social organizations adopt and integrate technology to enhance efficiency and leadership competency, resulting in task automation, improved data management, and increased productivity. However, challenges such as limited resources, resistance to change, and data security concerns need to be addressed. Recommendations include developing a clear digital strategy, investing in leadership development, fostering an innovative culture, prioritizing data governance and security, promoting ethical practices, fostering collaborations, evaluating impact, providing training and support, adopting agile methodologies, and staying informed about technological trends. Implementing these recommendations will enable social organizations to navigate digital transformation effectively and achieve greater efficiency and social impact.

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# Landslide for Education; A Case Study from the Mitigated Landslide at the Kahagalla, Haputhale

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**Abstract**— This study focuses on the Kahagalla landslide mitigated site, an exemplary landslide mitigation and management project. The purpose of this study is to provide valuable insights from the Kahagalla landslide mitigated site, which can be utilized for educational purposes in the fields of geography, geology, civil engineering, and disaster management. This case study is a qualitative study that used field observation as the primary data collection method and relevant documents as the secondary data collection method. Data were analyzed using the thematic analysis method. The case study analyzes the background of the landslide site, the measures taken for mitigation, and the overall success of the project. It also highlights the importance of this site to use as an educational site. The results reveal that the Kahagalla landslide site can give proper knowledge on landslide education. Further, the site is rich in different landslide mitigation methods and accessible. So, the recommendation is to use these kinds of available sites in Sri Lanka to enhance the practical knowledge of education.

**Keywords**— Landslide, Education, Mitigation Site, Countermeasures.

## I. INTRODUCTION

Sri Lanka is a well-known country experiencing landslide disasters which are the commonest. Though landslide disaster frequently occurs, awareness among the people is limited, hence every year some communities are affected. It is well noted that the number of cutting failures has been increasing recently in the country indicating the lack of knowledge in slope stability. Hence awareness or education in landslide hazards and disasters must be well established in the country.

When giving education on disasters, its practical engagement should be more focused. The importance of education is not only book learning but also fieldwork to give students valuable real-world experience (Hirota, 2015). Further, field works allow a “deep study approach” instead of a “surface approach” (Molderez and Fonseca, 2018). So, the field visits along with the practical

sessions should be incorporated more in the education system.

Landslide education is available in different fields such as geography, geology, civil engineering and disaster management. The education on landslides can be conducted through field tours to such sites. The best locations should be safe sites where no further sliding is ensured. Such sites are the mitigated landslides. Mitigated landslides show the past sliding and also the way of mitigation, hence such sites are safe sites for education. If the site is very close to a major road with easy access, that can be an ideal location for promoting landslide education.

The Kahagalla earth slip which was a unique landslide first occurred in 1957 (Wijesinghe et al, 2016). Kahagalla landslide was classified as a creep type of landslide, which has a slow downward movement of soil and debris materials. The main landslide body extends about 650 m on a gentle slope. However, some community buildings and infrastructures exist just below the landslide, while a stream is drained adjoining the landslide. Badulla Colombo road had been continuously damaged annually during the rainy seasons due to the movements of the slide. To avoid this impact, the area was protected by landslide mitigation methods.

This study will discuss the possibility of using Kahagalla mitigated landslide site for educational purposes.

## II. METHODOLOGY

Data collection and data analysis methods are discussed in this section.

Field observation as the primary data collection method has been used to observe the site and identify the countermeasures of the site. Further, GPS (Global Positioning System) points have been collected to identify the absolute location of the site. Furthermore, published papers have been used as the secondary data collection method.

The above-collected data was analysed using the thematic analysis method. When considering the process of the

analysis, all the collected data were prepared for analysis by putting memos and comments. Then as the second step of the process of analysis, read through the data. Later on, the data was coded. The themes were generated based on the codes.

“Location of the site”, “Landslide Education and the Kahagalla Site” and “Benefits of Using Kahagalla Site for Education” are the themes that could be identified through thematic analysis.

### III. RESULT AND DISCUSSION

The results and discussion section has been organized according to the themes identified by the thematic analysis. These results will reveal the valuable insights and lessons learned from the Kahagalla landslide mitigated site, which can be utilized for educational purposes.

#### G. The location of the site

Location is one of the important factors when considering a site for an educational purpose because accessibility is crucial. The absolute location was identified by taking the GPS coordinates of the site at the field observation, as shown in Figure 1.

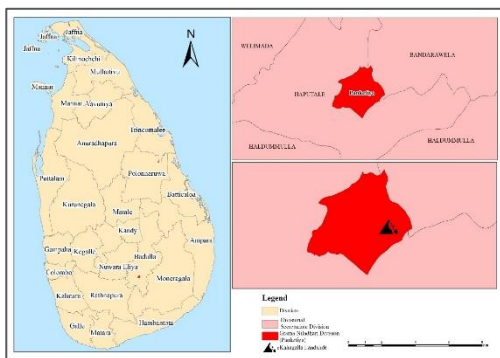


Figure 1. Map of the site

Source: Prepared by the Author, 2023

This site is in the Panketiya Grama Niladhari division of the Haputale Divisional Secretariat Division of the Badulla District of Uva province.

The Haputale-Bandarawela road runs across the toe of the landslide. Further, there is a village at the bottom of the landslide site. Google Earth map has been used to identify the relative location as clearly shown in figure 2.

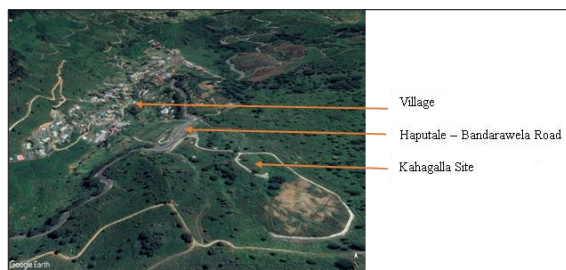


Figure 2. Relative location of the site

Source: Prepared by the Author, 2023

This location is feasible to access. Many educational trips are organized to hill country and this site also can be accessed on the way to other destinations.

#### H. Landslide Education and Kahagalla Site

Landslide education discusses topics such as the definition of landslide, types of landslides, features of landslide, causes of landslide, identifying landslide hazards, identifying landslide risk, impacts of landslide and landslide mitigation among many others. Even though teacher-centered basic knowledge should be given to get the approach to the topic and explain the theories, a case study can be used even from the beginning in landslide education.

In education, scientifically proven information is critical. When considering the Kahagalla landslide, information with a scientific base is available as published papers and documents from the National Building Research Organization (NBRO) which is the responsible organization for landslides.

The nature of the Kahagalla landslide can be identified using the published papers. Kahagalla landslide was slowly moving towards the toe area (Wijesinghe, 2016). The slope was specified by sinking soil, dominated by colluvium and residual components, at the scar area due to calc-silicate solution cavities. Further, the circular-type rotational failure in the middle and moving soil at the toe area could be found. The slip surface which was caused by water pressure in pores due to the infiltrated water and water in the solution cavities was located at a depth of 15.8m. The subsurface of the Kahagalla slope mass was formed by the breakdown of underlying layers of garnet, biotite, sillimanite, gneiss, and an impure crystalline limestone layer that existed towards the head scarp (Amarasinghe, 2022). The studies highlight the role of weak soils in the development of the slip surface, the influence of solution cavities in the underlying marble bedrock on the development of high pore water pressure, and the soil weakening character of the relict discontinuities of the underlying rocks of Kahagalla landslide. The triggering factors have been identified as surface water, groundwater, and erosion at and around the toe by the streams limiting the landslide area (SCRIBD article). For these triggering factors, the topographic condition of this area is significant because the rainfall in the surrounding area flows into the site as forms of both surface water and groundwater.



Moreover, the works of the literature revealed the structure of the site. This site can be categorized into four blocks (Karunawardena, 2021) as shown in figure 3.

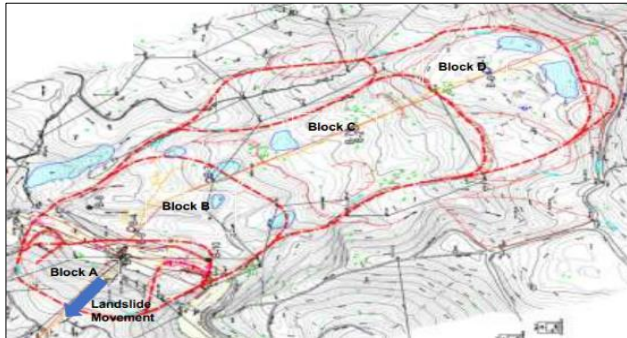


Figure 3. Blocks of Kahagalla Landslide  
Source: Karunawardena et al, 2021

Block A was a highly active part of the site and it was located at the bottom of the landslide across the A016 road. Small water pools were observed in block B after heavy rain. Further, the height of the scarp was about 3m the main part of the block was gentle, but had disturbed the slope. Block C consisted of a scarp of about 5m and the bare ground around the scarp. Block D had a steep slope along with the estate road corresponding to the head scarp. Spring water was observed along the road and some water pools & surface water flow have been observed in this block.

Further field observations prove that the Kahagalla landslide site is a suitable location for identifying countermeasures for landslides. In disaster risk reduction measures structural and non-structural measures are considered. These structured disaster risk reduction measures can be divided into two engineering and non-engineering measures. In the Kahagalla landslide site, these engineering and non-engineering structures can be clearly identified. The nature of the natural conditions and their applications should be considered before applying these countermeasures. This is what especially teaching in higher education, the practical scenarios. This site can be used as one of the real-world applications for explaining landslide disaster risk reduction measures in fields such as geography, geology, civil engineering, and disaster management.

Countermeasures on the site are important because those are the more attractive features on the site. Those can be identified as monitoring and mitigation methods.

Water gauges as shown in figure 4 are used to monitor underground water levels, which helps to reduce the risk of landslides by providing information about how the water level fluctuates.



Figure 4. Water gauge  
Source: Photo taken by the Author, 2023

The Drainage wells in this site were designed as a cascading system as shown in figure 5. This system aids in the withdrawal of water from the hill area to the valley, lowering the groundwater level.

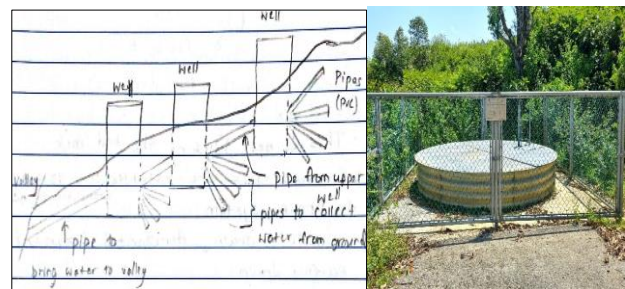


Figure 5. Drainage Wells  
Source: Drawn and the photo taken by the Author, 2023

For this drainage well system, specific pipes have been used to transport water from one well to another by collecting water from the soil.

Other mitigation techniques that have been used on this site are soil nailing and ground anchoring. Ground anchors have been installed just above the road as part of the soil-strengthening strategy. Concrete slabs have been erected to connect the anchors. This aids in the prevention of shallow landslides, which cause frequent damage to the road. This structure attracts road travellers because it provides a view of the site as shown in figure 6.

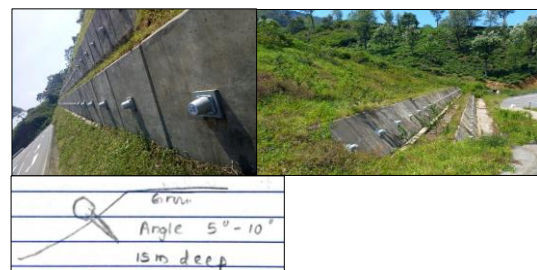


Figure 6. Ground anchors  
Source: Drawn and the photo taken by the Author, 2023

Another method that has been used for mitigating the landslide in this location is installing a drainage system as in Figure 7. In this location, cutoff drain, horizontal drain, and surface drain could be identified. Surface drains were



constructed to intercept and divert surface runoff, reducing infiltration and diverting surface water away from the landslide.



Figure 7. Drain System

Source: Photo taken by the Author, 2023

The drain system has been implemented to remove the surface water when it is raining. This has been constructed in a sufficient way. The reason for this is that the drains are well connected to each other.

A bridge also has been constructed at the site as one of the mitigation methods as shown in Figure 8.



Figure 8. Drain System

Source: Photo taken by the Author, 2023

This bridge has been constructed using a honeycomb structure that is light in weight. Bubbles in the concrete were used to make this structure lightweight. It denotes the presence of gas bubbles in the concrete. Despite the fact that this is a costly method, it reduces the structure's weight. Further soil nailing has been used just above this.

Another mitigation method that can be identified at the toe of the landslide and the crown of the landslide is a method of soil bioengineering. Plants have been planted in these locations. However, when doing these things, their focus has been on the weight on the ground, which should be less to avoid pressure. As a result, bushes have been planted at the landslide's crown as shown in Figure 9 because the weight on the land is less. Trees have been planted at the foot of the landslide to increase the weight of the land, allowing it to bear the soil and prevent erosion. The plants used for this method should have higher evaporation capacity, a strong root system, and be easy to maintain.



Figure 9. Bushes on the site

Source: Photo taken by the Author, 2023

Furthermore, earth removal at the landslide's head and counter embankment construction at the landslide's toe were completed to balance the force and improve the landslide's overall stability.

To stabilize the landslide, the countermeasures which have been discussed were designed and built on the site using Japanese technology. So, this site can be used as a knowledge dissemination center.

By examining these kinds of real-world applications and successful landslide mitigation projects, students can gain practical insights into the challenges, strategies, and outcomes associated with mitigating landslides.

### *I. Benefits of Using Kahagalla Site for Education*

There is a significant number of landslide mitigation sites in Sri Lanka but the Kahagalla site can be emphasized as the only site with different landslide mitigation and monitoring measures in Sri Lanka.

Enhancing technical knowledge is very important in education. Landslide mitigation sites showcase the application of engineering techniques and technologies specifically tailored to mitigate landslide risks. By studying this site, students can gain a deeper understanding of geotechnical engineering principles, slope stability analysis, soil stabilization methods, and other technical aspects of landslide mitigation.

Further, studying landslide mitigation sites such as Kahagalla site allows students to understand the interdisciplinary nature of addressing landslide risks. They can explore how different disciplines contribute to planning, designing, implementing, and monitoring mitigation measures.

Moreover, Kahagalla landslide mitigation sites offer valuable lessons in risk assessment and management. Students can learn how to identify landslide-prone areas, assess potential risks, and develop strategies to minimize

the impact of landslides on communities and infrastructure. They can explore techniques such as slope monitoring, early warning systems, and land-use planning to reduce vulnerability to landslides.

Community engagement and resilience are also one of the important areas in landslide education. Landslide mitigation projects often involve community engagement and participation. This Kahagalla project is also the same. Studying this site helps students understand the importance of involving local communities in decision-making processes, raising awareness about landslide risks, and building resilience. Students can explore methods for effective communication, community empowerment, and the social dimensions of disaster management.

Environmental considerations should be emphasized in learning. These landslide mitigation sites prioritize environmentally friendly approaches to minimize ecological impacts. Soil bioengineering is an example of this. Students can learn about sustainable engineering practices, the preservation of natural ecosystems, and the integration of ecological principles into landslide mitigation strategies.

Policy and governance are significant sections that should be focused on in landslide education. Studying landslide mitigation sites can shed light on the policy and governance frameworks that govern such projects. Students can examine the role of government agencies, regulations, and standards in ensuring effective mitigation measures. They can also explore policy challenges, funding mechanisms, and the importance of long-term planning and maintenance. Kahagalla landslide is one of the sixteen proposed mitigation sites under the Landslide Disaster Protection Project (LDPP) in Sri Lanka (Wijesinghe et al, 2016) and many stakeholders such as Japanese International Cooperation Agency (JICA), Road Development Authority (RDA), Oriental Consultants Co, Ltd (OC), Kokusai Kogyo (KKC), Engineers and Architects Associated Private Limited (CEA) and National Building Research Organization (NBRO) were involved.

By studying landslide-mitigated sites, students gain a comprehensive understanding of the complex factors involved in mitigating landslide risks. Kahagalla landslide site also has the capacity to provide knowledge to the students. This knowledge can contribute to more effective and sustainable approaches to managing landslides in the future, thereby reducing the potential for loss of life and property caused by these natural hazards.

#### *J. Conclusion*

By studying the Kahagalla landslide mitigated site, students and professionals can gain valuable knowledge about the landslide, landslide mitigation strategies, their

implementation, and the importance of comprehensive planning and monitoring. This case study serves as a practical resource for educators and researchers to identify the landslides with the aim of enhancing understanding and preparedness for landslides in vulnerable areas.

#### *K. Recommendation*

This study explains the capability of the Kahagalla landslide mitigation site to be used for educational purposes. So, the ultimate recommendation is to use these kinds of available sites in Sri Lanka to enhance the practical knowledge of education. Further, how to use this site as an educational site should be considered. When the Kahagalla landslide site is used as an educational site, different stakeholders like state and local governments, private land owners, media, university students and school children can be identified. Analysing stakeholders and identifying their roles and responsibilities in using these kinds of sites as educational sites are recommended for future research works.

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# The importance of social work as a practising profession to enhance gender mainstreaming in sustainable development in Sri Lanka

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**Abstract**— This research paper delves into the applicability of gender mainstreaming in the context of Sri Lanka and its crucial role in sustainable development, particularly within the field of social work. Employing content analysis, the study examines secondary data to shed light on this topic. Gender mainstreaming, which seeks to incorporate gender perspectives and foster equality in decision-making and development initiatives, is explored through the lens of UNESCO's guiding principles, including recognition, diversity, equality, empowerment, participation, partnership, and social justice. The paper highlights the necessity for gender mainstreaming within the Grand Challenges for Social Work initiative and assesses the existing policies in Sri Lanka. Although existing policies acknowledge the significance of gender perspectives, the paper underscores the need for heightened awareness and sensitivity in development programmes to prevent the perpetuation of gender disparities. Despite high literacy rates, various challenges, such as social norms and limited economic participation, may impede the effective implementation of gender mainstreaming in sustainable development. The study emphasises the pivotal role of social work in addressing gender-based issues aligned with the Sustainable Development Goals and advocating for inclusivity and empowerment. Additionally, the research addresses the challenges encountered by local social workers, such as non-indigenous education, limited agency support, the self-determination of service users, and the influence of cultural and religious factors. Recognising and addressing these challenges necessitates greater acknowledgment and support for the social work profession and ethical decision-making. Ultimately, the paper concludes by underscoring the significance of gender mainstreaming in social work as a means to achieve inclusivity, equality, and empowerment. It calls for the integration of gender perspectives in policies, programmes, and practises to advance social justice and ensure a more equitable society.

**Keywords**— Social Work, Sustainable Development, Gender Mainstreaming, Gender Inclusivity

## I. INTRODUCTION

Over the past three decades, Sri Lanka has demonstrated strong growth and development. With average annual per capita GDP growth of 4.4% in the 1990s, 4.2% in the 2000s, and 4.4% in the 2010s, the country has maintained a positive trajectory despite the disruptions caused by the Civil War. This economic growth has contributed to advancements in human development, as indicated by the country's human development index (HDI). From 1990 to 2019, Sri Lanka's HDI increased by more than 24%, rising from 0.629 to 0.782. This places Sri Lanka in the "high human development" category, ranking 72nd out of 189 countries in the 2020 Human Development Report (UNCTAD, 2022). According to UN Women (2022), Member States of the United Nations have supported gender mainstreaming as the primary global approach for achieving gender equality and empowering women since the Fourth World Conference on Women in Beijing in 1995. Over the past 25 years, they have consistently emphasised the significance of this strategy and the urgency of its implementation across all development sectors. Furthermore, the 2030 Agenda for Sustainable Development strongly emphasises the potential transformative power of gender mainstreaming, calls for its accelerated implementation, and recognises that gender equality and women's rights and empowerment are essential for achieving sustainable development in all areas. The Global Agenda for Social Work and Social Development aligns with the Post-2015 Development Agenda and aims to address social issues and developmental challenges at both local and global levels. The 2030 Agenda for Sustainable Development serves as a framework for integrating the Global Agenda's commitments into creating a more equitable society. Studies reported in the Special Issue of International Social Work (2014) explore the potential implications of the Global Agenda for social work education and practise (Lombard, 2015). As a client-centred discipline, social work encourages all genders to equally participate in the development of a nation. The research highlights the role of social workers in addressing gender inequalities and integrating gender perspectives into development policies and programmes. By examining the specific context of Sri Lanka, the focus is on understanding how social work can

contribute to achieving the Sustainable Development Goals (SDGs) related to gender equality and women's empowerment. The aim is to emphasise the essential role of social work in fostering inclusive and gender-responsive sustainable development practices in Sri Lanka.

## II. RESEARCH AIM AND OBJECTIVES

The aim of this research is to explore and understand the role of social work in mainstreaming gender perspectives for achieving sustainable development goals in Sri Lanka. The research will focus on identifying challenges, opportunities, and strategies for integrating gender equality considerations within the field of social work practice to contribute to the realisation of the 2030 Agenda for Sustainable Development.

Research Objectives:

- To assess current gender mainstreaming progress and challenges in Sri Lanka.
- To analyse social work's role in addressing gender inequalities and promoting gender-sensitive development.
- To explore challenges faced by social workers in integrating gender perspectives.
- To advocate for increased recognition of social work's role and contribute to gender-responsive policy dialogues.

## III. METHODOLOGY AND EXPERIMENTAL DESIGN

This qualitative secondary study is conducted with the main objective of understanding how gender mainstreaming could be incorporated into the sustainable development of Sri Lanka within the scope of Social Work. Data collection involves the identification and retrieval of relevant secondary data sources. In this research, a comprehensive array of secondary data sources has been consulted to acquire pertinent information about gender mainstreaming and sustainable development in Sri Lanka. These sources encompass academic and government databases, reports, and publications. Noteworthy references include Archibong et al. (2018), addressing gender mainstreaming and sustainable development in Nigeria. The Asian Development Bank's (2015) updated Country Gender Assessment for Sri Lanka offers insights into local gender dynamics. Jamil et al. (2020) contribute insights into South Asian gender mainstreaming in various domains. Studies by Jayasooria (2016), Lombard (2015), Messing (2020), and Wijesekera (2020) delve into the role of social work in sustainable development. UNCTAD's report (2022) highlights gender mainstreaming cases in Ethiopia, Indonesia, and Sri Lanka. UN Women's

resources, including the Handbook on Gender Mainstreaming (2022) and online documents, provide a global perspective. The Sustainable Development Report 2023 by Sachs et al. (2023) enriches the assessment by contextualising sustainable development efforts. Content analysis is employed as the primary method for analysing the collected secondary data. A coding scheme is developed to systematically categorise and classify the content based on relevant themes and variables related to gender mainstreaming and sustainable development. Ethical considerations focus on ensuring the appropriate use of secondary data sources. Data confidentiality is maintained, and copyright regulations are adhered to. Any potential biases or limitations inherent in the secondary data are acknowledged and addressed. The scarcity of research on gender mainstreaming in social work practice highlights a potential limitation regarding the availability of secondary data. This study aims to shed light on the importance of engaging in social work across various domains to promote gender-sensitive sustainable development.

## IV RESULTS

### A. Gender Mainstreaming and Social Work

As UN Women (n.d.) states, mainstreaming involves ensuring that gender perspectives and attention to the goal of gender equality are central to all activities: policy development, research, advocacy and dialogue, legislation, resource allocation, and planning, implementation, and monitoring of programmes and projects. Gender mainstreaming, as explained by Archibong et al. (2018), is a policy strategy that seeks to incorporate women in all areas of decision-making and development programmes. Its goal is to bring gender issues into the mainstream of society and promote gender equality. This strategy aims to ensure that women are included and represented in all spheres of society on an equal footing with men (Kanjere & Rachid, 2014). The goal of achieving gender equality on an international and global scale is to ensure that women and men are equally valued for their behaviours, aspirations, and opinions and that their rights, responsibilities, and opportunities are not determined by their gender differences, which are socially constructed identities (Elegbede, 2012). This means that men and women should have equal status, entitlements, rights, and access to assets and services, free from limitations imposed by gender norms and stereotypes. Gender norms and roles shape expectations around power positions, resource access, and decision-making in areas such as reproduction, sexuality, family planning, marriage, and household labour. Recognising and understanding these realities is crucial for addressing violations of women's rights and reducing constraints on equal rights, choices, and opportunities for women and

girls (Acha, 2016). The American Academy of Social Work and Social Welfare is in charge of the Grand Challenges for Social Work initiative, which aims to solve the most important issues facing society. While the initiative covers a wide range of topics, including poverty, health, and climate change, it fails to explicitly include gender in its titles or descriptions.

Given that women experience social issues being addressed disproportionately, this special issue emphasises the need to mainstream a gender perspective within the grand challenges. To identify and address gender inequalities and advance social justice, gender mainstreaming—which is influenced by intersectional and feminist theories—is crucial. By focusing on gender equality in research practice and policy recommendations, the grand challenges can truly advance the profession and contribute to a more equitable society (Messing, 2020).

#### B. Guiding Principles for Gender-Mainstreaming

Archibong et al. (2018) point out the eight guiding principles established by UNESCO (2007) for its gender mainstreaming policy. These serve as a framework for UNESCO's commitment to gender mainstreaming and promoting gender equality in all its endeavours:

- 1) *Recognition*: Gender issues are present in all aspects of international cooperation, including management systems, policies, culture, and work methods. Acknowledging these issues is crucial to addressing systemic barriers to gender equality.
- 2) *Diversity and intersection*: Different policies and programmes affect men and women differently, and within each gender, specific sub-groups may experience distinct forms of discrimination and marginalisation that need to be acknowledged and addressed.
- 3) *Equality*: Gender equality necessitates protecting and promoting the human rights of all individuals, regardless of age or gender, and ensuring equal opportunities for everyone.
- 4) *Equity*: Measures should be designed to eliminate disparities, stereotypes, and discrimination between genders, with a focus on supporting the most disadvantaged sex. Equity compensates for unequal opportunities and ensures fairness in programmes.
- 5) *Empowerment and agency*: Empowering individuals, including boys, girls, women, and men, is crucial to meeting their immediate needs and long-term goals. UNESCO supports processes that enhance self-

confidence, self-reliance, and self-determination for both genders.

- 6) *Participation and parity*: Achieving gender equality requires equal participation of men and women as agents of change in economic, social, and political processes.
- 7) *Partnership between women and men*: Empowering women does not mean excluding men; it involves establishing partnerships that empower both genders and provide them with equally pivotal roles in creating more equal societies.
- 8) *Social Justice*: Poverty reduction efforts alone are insufficient to address gender inequalities. Combating gender inequality is essential, along with poverty reduction, to achieve true effectiveness and social justice. All these guiding principles align with the core values and principles of social work, including promoting human rights, addressing social inequalities, and working towards inclusive and equitable societies.

#### C. Gender Mainstreaming in Sri Lankan Social Work

The integration of gender mainstreaming approaches, as emphasised by UN Women (2022), is of great importance. This integrated approach focuses on ensuring that gender equality is effectively addressed in all aspects of development policy and practice, including policies, programmes, activities, outcomes, and results. The primary objective is to promote gender equality and attain favourable outcomes. By aligning these approaches with the fundamental principles of social work, sustainable development can be effectively pursued.

- 1) *Approach 1- Address gender equality in all sectors and policy areas*
- 2) *Approach 2: Institutionalise attention to gender equality within organisations when using the integrated approach to gender mainstreaming*
- 3) *Approach 3: Give attention to gender equality from the initial stages, using gender analysis*
- 4) *Approach 4: Focus on gender equality results through transformative change in policies, processes, and outcomes*
- 5) *Approach 5: Broaden and strengthen women's equal participation in decision-making and enhance their leadership roles*

#### D. Policies Related to Gender Mainstreaming in Sri Lanka

Gender mainstreaming has been addressed in several sectoral policies in Sri Lanka. Specifically, the National Human Resources and Employment Policy and the



National Policy Framework for Social Integration have recognised the importance of gender as a cross-cutting issue. The former policy highlights the importance of gender mainstreaming in employment, with the objective of promoting women's participation in the labour market and improving job opportunities. It proposes a range of measures to address gaps in practices and attitudes, including support services for childcare and elderly care, flexible work arrangements, and training for higher-skilled positions. These policies highlight the need to incorporate gender perspectives and promote gender equality in their respective sectors. By acknowledging gender as a key factor, these policies contribute to the overall efforts of gender mainstreaming in Sri Lanka (Asian Development Bank, 2015). However, the report further points out that Development programmes in Sri Lanka often suffer from a lack of sufficient gender awareness and sensitivity in their design, implementation, and monitoring processes. This means that gender perspectives and considerations are not adequately integrated into these programmes. As a result, gender inequalities and issues may not be effectively addressed, leading to limited impact and the potential perpetuation of gender disparities. It is crucial to enhance gender awareness and sensitivity in the development sector to ensure that programmes are inclusive, equitable, and responsive to the specific needs and experiences of all genders.

#### *E. Social work as a practise profession to tackle gender-based issues in development*

According to the Sustainable Development Report (2023), Sri Lanka has major challenges to remain in gender equality (SDG5) since its score is stagnating or increasing at less than 50% of the required rate. Speaking of SDG 5 indicators, the following information is reported:

- 1) *Indicator 1: Demand for family planning is satisfied by modern methods* - Challenges remain, with scores stagnating or increasing at less than 50% of the required rate.
- 2) *Indicator 2: Ratio of female-to-male mean years of education received* - SDG achieved, on track or maintaining SDG achievement
- 3) *Indicator 3: Ratio of female-to-male labour force participation rate* - major challenges remain with a decreasing score
- 4) *Indicator 4: Seats held by women in national parliament* - Major challenges remain, with scores stagnating or increasing at less than 50% of required rate. So there is a major controversy between the education level and the economic participation of males and females in the country.

Gender mainstreaming is a crucial aspect of both the SDGs and social work values. As mentioned by Jayasooria (2016), the SDGs emphasise human dignity,

inclusivity, equality, and empowerment, which align with the principles social workers adhere to in their practise. Additionally, the target groups identified in the SDG agenda, such as women, children, and youths, highlight the importance of addressing gender-related issues. By integrating a gender mainstreaming approach, social workers can effectively advocate for and empower marginalised groups, including women, to ensure their rights and needs are met in achieving the SDGs. The GAD (Gender and Development) approach, as highlighted by Jamil et al. (2020), draws on the theoretical foundations of socialist feminism. It underscores that the successful implementation of gender mainstreaming hinges upon the unrestricted expression and agency of both genders within societal spheres. Applying this to the field of social work in Sri Lanka, this necessitates active engagement from families, religious leaders, and other social actors in fostering an inclusive environment that enables individuals, regardless of gender, to freely pursue their preferences without the fear of reprisal or harassment. While state policies, economic advancements, and civil society advocacy can facilitate the process of gender mainstreaming and empower women, true progress can only be realised when the social context actively supports and facilitates such freedoms. Without a nurturing social milieu, the empowerment of women and the achievement of gender equality will remain distant aspirations.

#### *F. Challenges Faced by Local Social Workers in Mainstreaming Gender in Sustainable Development*

While Sri Lanka has made notable progress in closing gender gaps in education and health, challenges persist in achieving gender equality. Women's Human Development Index (HDI) reached 0.759 in 2019, slightly lower than men's HDI at 0.794. One significant challenge lies in women's low economic participation, with an employment rate of just 31.2% in 2019. This rate has remained nearly unchanged over the past 30 years, significantly below the employment rate for men, which stood at 71.5% in 2019. Limited participation in the labour market restricts women's empowerment and their potential contributions to economic growth and development. Scholars attribute women's persistently low labour force participation to social norms that govern their roles in family and care work, creating barriers to women's entry into the labour market. Analysing the challenge of gender inequality in labour markets within Sri Lanka's structural transformation and aggregate labour productivity growth becomes crucial in addressing these issues (UNCTAD, 2022).

Confronting these gender concerns in development, Sri Lanka grapples with the challenge of establishing Social Work as a dynamic presence across social, economic, and



political domains. Wijesekera (2020) conducted an empirical investigation using 10 faculty members and 20 students from the Sri Lanka School of Social Work. Data was collected through interviews using a semi-structured approach. The findings revealed that 72% of the field supervisors acknowledged the influence of non-indigenous social work education and the Western orientation of the curriculum on the understanding of social problems in Sri Lanka. They observed that the curriculum, instructional strategies, textbooks, lecturers, and backgrounds in higher education all show a strong influence of Western models on social work education in Sri Lanka. The field supervisors expressed a strong belief in the need for indigenization of social work education to address contemporary social issues effectively within the Sri Lankan context. Nanayakkara & Jayawardana (2018) further pointed out the challenges related to social work ethics in fieldwork practise. These challenges are also evident when it comes to comprehending gender mainstreaming in the context of Sri Lankan social work.

- 1) *Lack of recognition for the social work profession in Sri Lanka:* Despite the presence of an acknowledged social work education program, the recognition of social work as a profession is limited in Sri Lanka. In the same vein, the significance of gender mainstreaming within this profession lacks widespread acknowledgment in the country. This lack of recognition acts as an obstacle to the progression of social work ethics and the establishment of an ethical code tailored to gender equality considerations.
- 2) *Limited support from field agencies:* Social work practitioners face challenges in applying social work ethics due to the rules and regulations imposed by field agencies. This can restrict their ability to practise ethically, particularly in terms of maintaining client confidentiality.
- 3) *Challenges to self-determination of service users:* The right to self-determination, a core principle in social work, is often violated in settings such as children's homes, elder care facilities, and hospitals. Professionals tend to make decisions for clients rather than empower them to make their own choices. In Sri Lanka, gender equality and service user empowerment barriers are evident. Sources like the UN Women's report on "Gender Disparities and Labour Market Challenges" reveal how workplaces hinder women's equal job access due to various factors, including employers' biases (UN Women, 2022). Additionally, domestic violence shelters face operational challenges, potentially jeopardising survivor protection due to resource constraints

(Sunday Island, 2022). These instances illustrate barriers to gender equality and service user empowerment in the Sri Lankan context.

- 4) *Cultural and religious impacts:* Cultural and religious beliefs can pose ethical challenges for social workers. Controversial issues such as commercial sex work, abortions, reproductive rights and LGBT rights can create value dilemmas for social workers who may feel conflicted due to cultural or religious beliefs. It is important for social workers to navigate these issues ethically, respecting different beliefs while ensuring the well-being of service users and the sustainable development of the country.

Tackling these profession-related obstacles holds potential to surmount contextual socio-economic barriers from a local standpoint. In sum, these challenges underscore the requirement for increased acknowledgment and backing of the social work field in Sri Lanka, alongside addressing ethical decision-making involving cultural and religious elements.

## V DISCUSSION

Social work is a profession working at three levels: micro, mezzo, and macro. Gender mainstreaming requires the inter-relationship between all these levels since it is equally important to consider individual, institutional, and policy level interventions to facilitate gender equality in all dimensions. As a country that ranks 83rd in the Sustainable Development Index 2022 with an overall score of 69.40 out of 100 (Sustainable Development Report, 2023), Sri Lanka is halfway there to achieving overall sustainability by 2030. Compared with the past two decades, which scored 63.86 in 2000, 66.46 in 2010, and 69.4 in 2022, the country had a slight increase in ranking overall but has fluctuated in the past few years (69.58 in 2019, 70.05 in 2020, 70.19 in 2021, and 69.4 in 2022) with the economic crisis. With the economic crisis in Sri Lanka at present, this has become even more challenging, leaving the achievement of the SDG at a low pace compared to other South Asian developing countries like Bhutan (72.34) and the Maldives (71.27). Therefore, the importance of social work as a practice discipline is crucial in this context, especially to incorporate its professional tools and create a gender-inclusive society to achieve sustainability by 2030. In order to achieve this, collaboration between all the other goals and SDG 5 (gender equality) is highly important, since inequalities in gender in a country significantly affect its overall development.

## VI CONCLUSION

In conclusion, gender mainstreaming and social work play crucial roles in achieving sustainable development and gender equality in Sri Lanka. The integration of gender perspectives and attention to gender equality in all sectors and policy areas is essential to ensuring the effective implementation of development policies and programmes. By adhering to the guiding principles of gender mainstreaming, such as recognition, diversity, equality, empowerment, participation, and social justice, social work can contribute to creating inclusive and equitable societies.

Sri Lanka has recognised the importance of gender mainstreaming in various sectoral policies, such as employment and social integration. However, there is a need for enhanced gender awareness and sensitivity in development programmes to effectively address gender inequalities and promote equitable outcomes. Local social workers face challenges in mainstreaming gender in sustainable development, including low women's economic participation, social norms governing gender roles, and limited recognition and support for the social work profession, despite the fact that women have high literacy levels in the country.

To overcome these challenges, it is crucial to indigenize social work education, align it with the Sri Lankan context, and develop a code of ethics that upholds the principles of social work. Additionally, promoting the rights of self-determination for service users, addressing cultural and religious impacts, and fostering partnerships between different stakeholders are essential for ethical decision-making in social work practice.

By addressing these challenges and integrating gender mainstreaming approaches, Sri Lanka can make further progress in closing gender gaps and achieving sustainable development. Social workers, in collaboration with other sectors and actors, have a significant role to play in advocating for gender equality, empowering marginalised groups, and creating a society that respects and upholds the rights and needs of all genders.

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#### ABBREVIATIONS AND SPECIFIC SYMBOLS

GAD	Gender and Development
SDG	Sustainable Development Goals
UNCTAD	United Nations Conference on Trade and Development
UNESCO	The United Nations Educational, Scientific and Cultural Organisation

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# A Literature Survey on Facebook Intrusion: Predictors and Effects

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**Abstract**— Facebook has emerged as the leading social media platform globally, with billions of users engaging in social interaction, information dissemination, and community building. This research paper aims to explore the impact of Facebook on personal privacy and emotional well-being, with a focus on Sri Lanka as a case study. Despite its popularity, Facebook raises concerns regarding invasion of personal space and privacy, cyberbullying, exposure to harmful content, and social comparison, which can contribute to negative psychological outcomes such as depressive symptoms, psychological distress, and anxiety.

This study adopts a literature survey methodology, conducting a comprehensive search using predefined search terms on Google Scholar. The findings reveal that Facebook intrusion, characterized by excessive involvement and disruptive behaviors, is associated with addictive symptoms and emotional attachment. Various factors, including fear of missing out, narcissism, self-esteem, satisfaction with life, moral norms, and depression, have been identified as predictors of Facebook intrusion. Negative effects of Facebook intrusion include sleep problems, social isolation, reduced goal-oriented behavior, and impaired emotional functioning. However, the relationship between Facebook intrusion and mental well-being is complex, with some studies reporting positive associations with life satisfaction. Additionally, Facebook intrusion has implications for interpersonal relationships, contributing to relationship dissatisfaction and jealousy. This research contributes to a deeper understanding of the risks and benefits associated with social media platforms like Facebook, facilitating efforts to enhance user experiences and mitigate potential negative effects

**Keywords**— Facebook Intrusion, Perceived Personal Space, Disruptive Behaviour

## I. INTRODUCTION

Facebook stands out as the world's most active social media platform (Kemp, Kepios Analysis, 2023). Which is the largest social networking platform in the world consisting of 2.99 billion users (Meta, Inc., 2023). According to the latest figures, roughly 37.2% of all the

people on Earth use Facebook today. (Kemp, Facebook Users, Stats, Data and Trends, 2023). It caters for social interaction, information dissemination, and community building, which facilitates users to connect with like-minded individuals and discussion on various topics of interest (Journal of Computer-mediated Communication). According to a study by Kuss and Griffiths (2011), the chief purposes people use Facebook for socialization, entertainment, information seeking, maintaining relationships, and self-presentation. In addition to connecting on Facebook to find friends and share their personal experiences, users sought emotional support from virtual friends. It showed that Facebook, in essence, was functioning as a society created in virtual space with billions of users, some believing that it provided them with a sense of belonging and emotional support from like-minded people.

Despite the above-mentioned high usage, Facebook has a highly invasive impact on people's personal space and privacy (Barrett-Maitland & Lynch, 2020). Research suggests that excessive use of social media, including platforms like Facebook, can have negative consequences such as cyberbullying, exposure to harmful content, and social comparison. These factors may contribute to increased depressive symptoms, psychological distress, and a heightened sense of anxiety. Blurring boundaries between personal and public spaces may lead to a feeling of virtual intrusion, as individuals are compelled to share personal information, respond to messages and notifications, and face openly made false judgments (Wright, White, & Obst, Facebook False Self-Presentation Behaviors and Negative Mental Health, 2018). The constant availability and accessibility of social media have made the virtual world closer than ever to the real world. Being compelled to share personal information, respond to messages and notifications, as well as being subjected to openly made false judgments, all of which can be intrusive and overwhelming. This can lead to a feeling of anxiety, stress, and even depression (Wright, White, & Obst, Facebook False Self-Presentation Behaviors and Negative Mental Health, 2018). The constant availability and accessibility of social media have brought the virtual

world closer to reality, intensifying the potential for intrusive and overwhelming experiences.

Therefore, further research is required to gain a deeper understanding of the potential risks and benefits associated with social media platforms like Facebook, particularly concerning personal privacy and emotional well-being. Exploring these aspects will contribute to a better comprehension of the impact of social media in various domains and guide efforts to enhance user experiences and mitigate potential negative effects (Kemp, Kepios Analysis, 2023)..

## II. METHODOLOGY

This study was conducted as a literature survey. A comprehensive search was conducted on Google Scholar using a set of predefined search terms and inclusion criteria. The search was conducted in two steps. For the first step, the search term was ‘intitle: Facebook AND intrusion’. There were about 406 research titles matching these criteria. The results were filtered to include only those articles from 2018 onward, i.e., covering the past 05 years.

The reviewers then removed the redundant and unavailable entries and conducted an independent screening of the titles and abstracts of identified articles. Finally, a full-text review of the selected studies was conducted, resulting in a total of 30 articles.

## III. FINDINGS AND DISCUSSION

### A. *Defining Facebook Intrusion*

Facebook Intrusion is an increasingly occurring term in the research literature that is used to describe an excessive and unhealthy dependency on Facebook. Elphinstone and Noeller defined Facebook Intrusion as “excessive involvement in Facebook, disrupting day-to-day activities and interpersonal relationships”. (Elphinstone & Noller, 2011). It has also been defined as “an excessive involvement in Facebook that disrupts everyday activities and duties, manifesting itself in the compulsive use of the site and the neglect of social life.”

In some cases, the term “Problematic Facebook Use” (PFU) is also used interchangeably, though PFU includes both addictive symptoms and a preference for online social interaction as a means of mood regulation. In this work, we will only confine ourselves to the former sense, i.e., Facebook usage that mimics addictions. For example, users with high levels of Facebook Intrusion report failed attempts to reduce Facebook use as well as distress when they cannot use it. In this context, most authors take the term to cover not only the excessive use of Facebook but also the users’ emotional attachment to it (Blachnio &

Przepiórka, 2018). In this sense, we will only consider those works that use the term “Facebook Addiction” to be synonymous with Facebook Intrusion.

It must also be noted that problematic/addictive Facebook use has not been recognized as a formal psychiatric disorder in the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association, 2013) or the International Classification of Diseases (World Health Organization, 2018). Furthermore, some researchers emphasize that it is important not to over-pathologize intensive online activity (Brailovskaia & Margraf, 2022).

### B. *Measuring Facebook Intrusion*

A few instruments have been developed to measure the degree and intensity of Facebook addiction/intrusion. These include the Bergen Facebook Addiction Scale, Facebook Addiction Scale, and the Facebook Intrusion Questionnaire (Primi, Fioravanti, Casale, & Donati, 2021). All of them are either ad hoc developments or adaptations from items originally used to assess other behavioural addictions (Ryan, Chester, Reece, & Xenos, 2014).

The Bergen Facebook Addiction Scale (BFAS) is reported as the most extensively used measure (Primi, Fioravanti, Casale, & Donati, 2021). It originally contained 18 items, three reflecting each of the six core elements of behavioural addiction distinguished by Griffiths (Griffiths, 2005): salience (i.e., permanent thinking of Facebook use), tolerance (i.e., the enhanced time that must be spent on Facebook to experience positive emotions), mood modification (i.e., Facebook is used for mood improvement), relapse (i.e., reverting to old use pattern despite endeavours to reduce Facebook activity), withdrawal symptoms (i.e., feeling nervous without Facebook use), and conflicts (i.e., interpersonal problems because of the high intensity of Facebook use). However, the final edition contained only six items, each item referring to the past 12 months and is answered on a 5-point Likert scale ranging from 1 (very rarely) to 5 (very often) – though it must be mentioned that some research used the original 18-item scale as-is (Uysal, Satici, & Akin, 2013), and a 12-item scale has also been used (Hong, Huang, Lin, & Chiu, 2014).

The 20-item Facebook Addiction Scale (FAS) is a modified version of Young’s Internet Addiction Test (ÇAM & Onur, 2012). In recent literature, though, the term has largely been eclipsed and replaced by the BFAS.

The Facebook Intrusion Questionnaire, developed by Elphinstone and Noeller (2011), is based on the Mobile Phone Involvement Questionnaire (behavioural addiction

components and phone involvement). It consists of eight items (e.g., I have been unable to reduce my Facebook use) measuring eight aspects of behavioural addiction, namely, cognitive salience, behavioural salience, interpersonal conflict, conflict with other activities, euphoria, loss of control, withdrawal, and relapse and reinstatement. The items are rated on a 7-point Likert scale from 1—strongly disagree to 7—strongly agree.

### *C. Predictors of Facebook Intrusion*

In 2018, Błachnio & Przepiórka showed that a high level of fear of missing out and high narcissism were predictors of Facebook intrusion. (According to them, no previous studies were confirming a direct relation between Facebook intrusion and satisfaction with life or narcissism.) They also showed that a low level of fear of missing out, and high narcissism were related to satisfaction with life. Their findings are based on (online) snowball sampling of 360 Polish Facebook users (64% female, mean age = 22 with an SD=6.84) (Błachnio & Przepiórka, 2018). In 2019, The same authors demonstrated that a low level of self-esteem and satisfaction with life predicted Facebook intrusion. Similar to their study in 2017, this too, was an online snowball survey study using 597 Polish mobile phone users (mean age = 21.22, SD = 6.52) (Błachnio & Przepiórka, 2019).

Wright, White, and Obst, in 2018, with a sample size of N=211 reported that moral norms significantly predicted two types of false self-presentation (lying and dishonest liking) on Facebook and other platforms, of which, liking behaviours were associated with depression, anxiety, and stress. They speculate that this may be indicative of possible offline negative mental health. (Wright, White, & Obst, 2018).

Facebook intrusion has been demonstrated as a mediator between self-esteem and general distress; as well as between self-control and general distress (Przepiórka, et al., 2021). Future Time Perspective (FTP) goals have also been shown to be a negative predictor of Facebook intrusion while depression has been shown a positive predictor of Facebook intrusion (and sleep problems)(Przepiórka & Błachnio, 2020).

According to Langgaman, college students (sample: 365 students in Kalinga State University) experience anxiousness, and yet it did not emerge as a predictor for their Facebook usage. The Loneliness which students experience was shown to have little contribution to Facebook use. Loneliness was able to predict Facebook usage but only has little contribution to college students' Facebook usage (Langgaman, 2020).

In 2022, Cudo, Torój, Orzechowski, and Misiuro study the relationship between Facebook intrusion and self-control dimensions among (non-gaming) Facebook users, using a sample of 991 users (785 females). Their responses were analysed using structural equation analysis. They conclude that the behavioural mechanisms associated with Facebook Intrusion could be associated with a low ability to suppress/delay unwanted/improper actions (Cudo, Torój, Orzechowski, & Misiuro, 2022).

It is noteworthy that some studies make a distinction between Active Facebook usage and Passive usage. Active Facebook usage (but not passive usage) is positively linked to Facebook Addiction. Active Facebook usage has been shown to contribute to the experience of Facebook-related flow, which, in the long run, serves as an antecedent of Facebook Addiction. Also, individuals with past or present depressive symptoms were seen to be more susceptible to Facebook addiction (Brailovskaia & Margraf, 2022).

Facebook addiction is associated with increased use of both passive and active use as well as increased levels of loneliness and depression. Furthermore, Facebook addiction was closely related to social comparison, which was also associated with depression (Casingcasing, Nuyens, Griffiths, & Park, 2022).

It seems reasonable to investigate whether certain personality traits were related to Facebook Intrusion. According to a 2022 study using the OCEAN model of personality traits, agreeableness, openness to experience and conscientiousness were shown to be negatively related to Facebook addiction. Loneliness, narcissism, impulsivity and shyness were significantly correlated with Facebook addiction (Rajesh & Rangaiah, 2022). Furthermore, the same study showed that emotion-focused coping mediated the association between rash impulsiveness and Facebook addiction; results also showed that rash impulsiveness was directly associated with Facebook addiction.

The positive association between narcissism and Facebook addiction (FA) has been demonstrated aptly. Facebook flow is shown to positively mediate the link between narcissism and FA. Facebook use intensity (in turn), is seen to positively moderate the link between Facebook flow and FA (Brailovskaia, Bierhoff, Rohmann, Raeder, & Margraf, 2020). Neuroticism, too, is shown to play a role here: it is seen to moderate the predictive effect of Past-negative on Facebook addiction. High levels of neuroticism have been shown to foster Facebook addiction, even in the presence of low negative temporal orientation (Miceli, Cardaci, Scrima, & Caci, 2022).

#### *D. Negative Effects of Facebook Intrusion*

The negative effects of Facebook Intrusion have been extensively reported. Facebook intrusion has been shown to contribute positively to sleep problems (Przepiorka & Blachnio, 2020). Loneliness and Facebook intrusion have been shown to be reciprocally related (Przepiorka & Blachnio, 2019), which means that Facebook Intrusion may play a part in social isolation. It has also been shown to coincide with a low ability to focus on goals, and a low ability to induce efficient motivation and persistence to achieve higher-order goals (Cudo, Torój, Orzechowski, & Misiuro, 2022), which the researchers speculate may ultimately result in those users failing to maintain goal-directed behaviour. In addition, certain aspects of emotional functioning—rumination, trait anxiety, and emotional intelligence—have been shown to be related to Facebook intrusion (Blachnio, Przepiorka, & Cudo, 2023)

Problematic Facebook Use (PFU) (which in this case is being used synonymously with Facebook Intrusion) has been shown to fully mediate the relationship between the intensity of Facebook usage and depressive symptoms. This indirect relationship was seen to be especially strong among those who were young or scored high on neuroticism (Gugushvili, Täht, Ruitter, & Verduyn, 2022). However, this is far from a consensus. In a study conducted in 2018, for example, Facebook intrusion in Italy was shown to be associated with higher life satisfaction (Blachnio, Przepiorka, & Benvenuti, 2019).

Moving beyond the individual, Facebook Intrusion has been linked to relationship dissatisfaction, via jealous cognitions and surveillance behaviours (Elphinston & Noller, 2011). It has also been shown that excessive Facebook usage has an impact on families and other social units as well. Excessive (and addictive) use of Facebook has been shown to be a contributor to jealousy among married individuals, negatively and significantly affecting marital relationships with regard to social intimacy (Rashid & Muhammad, 2023).

#### IV. CONCLUSION

This research has shed light on the impact of Facebook on personal privacy and emotional well-being. The findings highlight the concerns surrounding Facebook intrusion, which is characterized by excessive involvement and disruptive behaviours that can mimic addictive patterns. The invasive nature of Facebook, coupled with factors such as fear of missing out, narcissism, low self-esteem, and depression, contributes to negative psychological outcomes including depressive symptoms, psychological distress, and anxiety.

While Facebook intrusion has been associated with various negative effects such as sleep problems, reduced

goal-oriented behaviour, and impaired emotional functioning, the relationship between Facebook intrusion and mental well-being is complex. Some studies have reported positive associations between Facebook usage and life satisfaction, indicating that the platform can also provide a sense of connection and fulfilment.

Furthermore, the research highlights the importance of considering the impact of Facebook on interpersonal relationships. Relationship dissatisfaction and jealousy have been identified as outcomes of excessive Facebook usage, emphasizing the need for individuals to balance their online and offline interactions.

These findings underscore the significance of further research in understanding the risks and benefits associated with social media platforms like Facebook. Such research can inform the development of strategies and interventions to enhance user experiences, mitigate potential negative effects, and promote healthy digital habits. It is crucial to strike a balance between the advantages of social connectivity and the preservation of personal privacy and emotional well-being in the digital age.

Overall, this research contributes to the ongoing dialogue on the impact of social media platforms, particularly Facebook, on individuals and society. It emphasizes the need for individuals, researchers, and policymakers to navigate the evolving landscape of social media use responsibly, considering both the potential benefits and risks to ensure a healthy and fulfilling online experience

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# Examining Patient Contentment with the Quality of Nursing Care in the Public Healthcare Sector

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**Abstract**— Patient satisfaction has grown in popularity as a vital component of determining the quality of care. A crucial part of quality improvement should comprehend with the viewpoint of patients as this is fully human centric. The degree of patient satisfaction with nursing care is a crucial indicator of the calibre of hospital treatment. A happy patient is more likely to recommend the hospital to others for treatment. To ensuring the proper levels of service improvement, it is vital to understand the factors that affect patient satisfaction with nursing care. This study aims to explore that how happy patients are with the quality of nursing care provided in hospitals. Many Sri Lankans, especially those who work as nurses or midwives, strongly believe that providing care alone is inadequate and believe nursing as a unique service rather than a career. This sensitive concern amongst nursing professionals underscores the significance they place on nursing care. In terms of research methodology, this study follows the qualitative approach, and the necessary data for the execution of the study were gathered through structures interviews around 100 patients reside in Ratmalana area. The primary focus of the sampling was patients who visit the hospitals monthly; outpatient clinics. The study deployed the thematic analysis.

The result of the study revealed that nurses have demonstrated effective management of both personal hygiene and cleanliness in their work environment. Additionally, nurses have exhibited competence in their professional roles as well. However, further development is needed in cultivating qualities such as politeness and kindness.

**Keywords**— Quality of nursing care, Patients Satisfaction, Medical sector

## I. INTRODUCTION

Since achieving independence, Sri Lanka has embraced a policy of healthcare, ensuring that all its citizens have access to free public healthcare services. The public sector offers healthcare services at no cost, while the private sector provides a wide range of healthcare options for a fee. In 2021, Sri Lanka allocated 3.8% of its GDP to

healthcare expenditure, which falls below the average health expenditure of 4.1% for lower-middle-income countries but surpasses the average health expenditure of 3.5% for South Asian nations (Budget Brief Health Sector Sri Lanka, 2021). Between 2015 and 2020, approximately 82% of Sri Lanka's public health expenditure predominantly consisted of recurring expenses, including salaries to healthcare professionals and the supporting staff (Budget Brief Health sector Sri Lanka, 2021).

In providing healthcare services, nurses play vital role in bridging connectivity between the healthcare services and patients. Nurses are regarded as the crucial factor in determining patients' satisfaction as they have a higher frequency of patients' interaction compared to other healthcare professionals (Johansson *et al.*, 2002). The nursing oath, which promises that nurses will do their utmost to serve patients and the nation, unites nurses as a knowledgeable and skilled team from the moment they start working in the field. The study aims to investigate the friendliness of nurses towards patients and assess patient satisfaction with nursing services revealed that the role of nurses in providing continuous care and treatment is significantly affect patients' satisfaction (Kruijver *et al.*, 2000).

The number of healthcare professionals and facilities in Sri Lanka is provided, indicating a shortage of medical care (Ministry of Health, 2021). With the COVID-19 pandemic, hospitals are overwhelmed with a rising number of patients. Nurses serve as intermediaries between doctors and patients, and conflicts between nurses and patients have been observed in high frequency level which leads to unsatisfied medical service (Karlsson, 2020).

Therefore, considering these background researchers tend to explore that, how happy patients are with the quality of nursing care provided in government hospitals in Sri Lanka and the need to improve the quality of nursing services.

#### IV. Problem Statement

As a human being, health is a much important thing. No one is without at least one little illness, either psychologically or physically. As a result, the hospital will serve as their place of healing. In the present situation, people are getting sick more than in past years due to unhealthy lifestyles, changing weather patterns and busy lives.

Accordingly, a report declared by the Ministry of Health, Sri Lanka in 2021 emphasized that 93 doctors and 214 nurses per 100,000 population, 643 hospitals and 86,589 hospital beds available in Sri Lanka. Therefore, there are 4 beds for 1000 people. By considering these factors, a scarcity of medical services could be identified in Sri Lanka.

There are three parts mainly patients, Doctors, and nurses can be seen in a hospital. Especially doctors and patients are the main parts since patients talk about their illnesses and doctors are the people that control and heal them (Dankyi *et al.*, 2020). But all other activities and linking of these two parties are done by nurses. Accordingly, nurses are the team that interconnects with the patient in this service (Johansson *et al.*, 2002). Therefore, many incidents happened between these three parties. In the present situation, many conflicts have occurred in a hospital between this parties. Therefore, current research is taken to understand the quality and satisfaction of nursing care.

There are plenty of articles, describing the satisfaction of patients with health care services in general. But there is a gap in satisfaction with the quality of nursing care. Previous studies indicate that, although patients' satisfaction with doctors' services has been studied, there is a discrepancy in the level of satisfaction with nursing care (Karlsson, 2020).

Therefore, this study fills the knowledge gap by analysing patients' satisfaction with the quality of nursing care in the medical sector.

#### V. Research Objectives

The main objective of this research is to determine patient satisfaction with the service of nurses. And also, there are sub-objectives to identify the nurser's personal qualities and how those factors impact on patient satisfaction and identify nurses' problem-solving ability.

## II. LITERATURE REVIEW

### A. Introduction

The purpose of the literature review is to provide definition of important issues, patient satisfaction, nursing care quality, and theories and concepts relating to the current study.

### B. Theoretical Background

According to the Henderson's theory (The Need Theory) by Virginia Henderson explains that nursing's unique function is to assist the individual, sick or well, in performing those activities contributing to health or its recovery (or to peaceful death), that she would perform unaided if she had the necessary strength, will, or knowledge (Ahtisham & Jacoline, 2015).

The Need Theory emphasizes the need of enhancing the patient's independence and concentrating on the fundamental needs of people to ensure that recovery from hospitalization doesn't take longer than necessary and focuses on the fundamental needs of people and how nurses can address them.

Linder-Pelz defined "patient satisfaction as a positive attitude" and presupposed a value expectancy model in the formulation of satisfaction (Williams, 1994).

Fishbein and Azjen defined attitude as the "overall assessment or feeling of favorability toward the object in the issue."

Based on the idea that "attitudes are moderated by environmental, individual, physical, psychological, or sociological variables," Tucker (2002) asserted that "socio-demographic attributes such as environmental, individual, physical, psychological, and sociological characteristics" should be used to measure patient satisfaction. Patient satisfaction and the social identity theory were given empirical evidence in. Patient assessments of access, communication, outcomes, and quality were important determinants of satisfaction (Tucker, 2002).

Patient satisfaction theory regarded patient satisfaction to be an attitude. According to her research, the patient's unique traits considerably contribute to their level of happiness (Linder-Pelz, 1982). This finding supports the social identity hypothesis, which claimed that views were adjusted and influenced by demographic, situational, environmental, and psychological aspects.

## III. Methodology

### A. Research approach, population, and sample

This research was inductive in approach. The objective of this research is to gain an understanding on patients' satisfaction in relation to the quality of nurses' service. The researchers discovered a dearth of research conducted in this field in Sri Lankan context, indicating that the study appears to be more of an exploratory nature. This aligns with the criteria outlined by Creswell (2007) for employing qualitative methodology.

The population taken for this study were patients who receive medical treatments monthly or visit clinics monthly in government hospitals in Colombo, Sri Lanka. The study aimed collect data from patients who receive medical treatments monthly or visit clinics monthly in government hospitals in Colombo, Sri Lanka due to the limited access to in-patients in government hospitals. Hence, the purposive sampling method was used as the most preferable. Accordingly, the researchers selected the sample of the current study as 35 patients who live in Ratmalana Area, Colombo.

**B. Data collection and Data analysis method**

The data were gathered using semi-structured interviews with 35 patients. An interview schedule consisting of open-ended questions was employed. Nonetheless, the questions were posed in a manner that was deemed most appropriate as the interview unfolded, using a few closed-ended questions as well.

The thematic analysis method was used for the analysis of the data. The ensured the research ethics through safeguards such as ensuring privacy and anonymity through consent forms, securely storing recordings and transcripts, and refraining from disclosing the names of interviewees.

The interviews have been carried out with 20 female patients and 15 male patients. Accordingly, the percentage has recorded 57% female patients and 43% male patients. Among the sample population of 35 respondents, a significant majority, comprising over 50%, fell within the age bracket of 40 to 50 years.

**C. Data analysis**

The thematic analysis was utilized in data analysis of the current study.

Thematic analysis is a qualitative data analysis technique that involves going through a collection of data and extracting themes by identifying significant patterns across the data. The most using process under Six steps; familiarization, coding, generating themes, reviewing themes, defining, and naming themes, and writing were used in the study.

**IV. RESULTS AND DISCUSSION**

This study systematically reviews the data on patients' satisfaction with the quality of nursing care in the government hospitals using thematic analysis. The thematic analysis method was used to manually analyse the collected data. All captured data through interviews was transcribed into individual sheets as the first step. As the next step, coding was conducted to identify repetitive answers and categorized them accordingly to generate meaningful themes support to the research objectives.

The interviews have been carried out with 20 female patients and 15 male patients. Accordingly, the percentage has recorded 57% female patients and 43% male patients.

The interview guideline encompassed a total of 24 questions, supplemented by occasional additional questions as needed to enhance clarity and obtain crucial insights from the respondents. Each respondent was engaged in an interview lasting between 30 to 40 minutes, ensuring ample time to gather pertinent and precise data.

**A. Understanding patient satisfaction with nurses' service:**

The respondents who participated in interviews expressed their ideas about the quality of nursing care as a patient.

The results of the analysis fabricated through coding and sorting of the findings contributed to generate the following themes with respect to understanding patients' satisfactions in relation to nurses' services.

Table 1: Themes related to understanding patients' satisfaction with nurses service.

<b>Patients' expectation on nurses' service</b>	<b>Nurses' Cleanliness</b>
Compassionate service Professionalism in providing services	Personal cleanliness/ Cleanliness of the place/premises

Source: (Authors)

**1) Theme 1: Patients' expectation on nurses' service**

In health care, patient expectations have been identified as a factor in patient satisfaction. The theme consists of two categorizations; compassionate service and professionalism in providing service.

**a. Compassionate service**

Simply caring or compassionate can be defined as someone being worried or distressed about something. Obviously, nurses are the closest people in the hospital to patients compared to other medical professionals. Hence, patients expect care from nurses continuously. Patients would like to gain the attention from nurses. More than 50% of the respondents were not in satisfactory level relating to the compassionate sense of the service provided by nurses.

"I felt down when I am walking to the doctor with the nurse. But that nurse did not care about me and she told me to come quickly." (Interviewee 01)

"Though my child cried continuously, the nurse didn't look at him. So, I also felt very upset." (Interviewee 05)

*b. Professionalism in providing services*

Nurses' main duty is to provide treatments to the nurses. Some of the main duties of nurses are obtaining blood samples, urine samples, and other bodily fluids for laboratory work; preparing of patients for examinations and treatment; engaging in wound care and providing support for medical procedures.

“Yes, obviously, private sector nurses took much time on obtaining blood from me. But government nurses did that quickly without painning me.” (Interviewee 07)

*2) Theme 2: Nurses' cleanliness*

Cleanliness can be defined as the quality or state of being clean or maintained in a clean state. Being clean is much important for patients since the availability of a high risk of entering the germs for the patient's body. Accordingly, that special requirement should be satisfied from the nurses' side as well. The theme generated based on two categorizations;

*a. Personal cleanliness*

Since nurses are treating the patients, they should be cleaned in every external aspect. Accordingly, washing or sanitizing their hands before moving to another patient or changing their gloves, and wearing clean dresses, can be done by the nurses in order to maintain cleanliness.

“Nurse sanitized her hand by the patient to patient. And the sanitizer was finished after some time. Also, the nurse wanted to re-place it quickly, a small-time went to bringing the sanitizer.” (Interviewee 31)

Some respondents compared the personal cleanliness with other medical professionals and commented.

“Actually, compare to other jobs, nurses are wearing clean dresses” (Interviewee 28)

*b. Cleanliness of the place/premises*

The concept of premises cleanliness entails the practice of thorough cleaning both prior to and following each patient investigation, as well as the proper removal of unwanted items from their designated locations. It is one of the most important things since germs can be spread to the patients from the garbage in the healthcare sector.

“Almost every nurse put the used injections to the respective just right after using them. (Interviewee 01)

“Nurses are keen on the cleanliness of the premises. One day I saw that a used cotton fell on the floor. Then that nurse quickly picked it up and put it in the garbage bin.” (Interviewee 33)

Based on the findings, it is evident that nurses play a crucial role in providing professional service to patients.

But still, they need to improve the compassionate sense of the service as patients have high expectations in this regard.

Maintaining cleanliness is of utmost importance due to the elevated risk of infections for patients. Although nurses are made to actively and continuously address this matter, there are challenges such as waiting for the replenishment of cleaning supplies and variations in support staff's service delivery.

*B. Identify the nurse's personal qualities on patients*

The analysis yielded significant findings that facilitated the identification of the following themes pertaining to the nurses' personal qualities and their impact in patients.

Table 2: Themes pertaining to the nurses' personal qualities

Patient-driven nursing care	Way of communication
Politeness	Speed of speaking
Respectability	Language supportiveness
Kindness	

Source: (Authors)

*1) Theme 1: Patient-driven nursing care*

The term "Patient-Driven" emphasizes the patient's central role in shaping their care experience, highlighting the importance of meeting their expectations for politeness, respectability, and kindness. These can be identified as traits expected by nurse as well. A trait is a characteristic, quality, or tendency that someone or something possesses.

*a. Politeness*

Politeness can be defined as the practical implementation of exemplary manners or etiquette to prevent causing harm or offense to others. Accordingly, politeness facilitates the reduction of negative feelings, making communication between patients and healthcare providers more effective.

“Yes, nurses communicated with me in a good way. I was never hurt when they communicate with me.” (Interviewee 05)

“Contrary to my request for a brief restroom break, the healthcare professional instructed me to quickly come to put the medicine. Consequently, I proceeded directly to the dressing room without having the chance to visit the washroom. (Interviewee 25)

*b. Kindness*

Kindness embodies the attributes of helpfulness, friendliness, and thoughtfulness. When individuals exhibit kindness towards others, it can be facilitating

transformations in their mental and physical well-being, ultimately resulting in a reduction in stress levels as well. Following are the few responses given by patients.

“I was screaming due to the pain on my legs. The nurse did not help to find a wheelchair for me. Instead, she shouted at me to stop screaming” (Interviewee 31)

“Though I had back pain, she told me to stand up quickly in an angry mood. Then I was helpless because I went alone into the clinic room without support. The nurse even did not allow my son to come inside.” (Interviewee 24)

*c. Respectability*

The term respect refers to the feeling or recognizing that someone or something is essential, serious, or should be treated appropriately. Respect is an essential thing in communication. Following are the few responses given by patients’ relation to respectability of nurses towards patients.

“Never.... They did not talk respectfully. They think that they are doing a social welfare activity, and they think we came to government hospitals due to no money to pay for private hospitals.

So, they think that we came there since we do not have any other options. So, we should tolerate all the disrespectfulness of them (Interviewee 17)

2) *Theme 2: Way of communication*

The way of speaking or communicating nurses with patient is identified under this theme. It consists of two categories, Speed of the communication and language supportiveness.

*a. Speed of the communication*

The rate at which nurses communicate has a significant impact as a personal quality on how patients understand the speech.

“Most nurses are speaking very fast since they have a lot of work to do. Once I again raise the same clarification, she replied in the same speed which I couldn’t catch the explanation” (Interviewee 19)

“The nurse ignored my question. Once I asked again, she replied with low volume.” (Interviewee 10)

*b. Language supportiveness*

Languages are the primary method of communication for humans, and they can be expressed orally, visually, or in writing. Besides, individuals who lack proficiency in a language that differs from their mother tongue require assistance and support for effective communication.

Followings are the answers given by respondents relating to language supportiveness of nurses.

I am not good at English. But the Doctor told me something in English and I could not understand them well. But the nurse understood my situation and she explained it me in Sinhala.” (Interviewee 24)

“I could not understand one medicine on the prescription, which is a new one. So, I saw it to the nurse, and she explained it me clearly”. (Interviewee 18)

Based on the above analysis, politeness in nurse-patient communication is crucial as patients feel embarrassed when nurses are impolite. Kindness has a positive impact on patients' mental health, as it strengthens the immune system, lowers blood pressure, and reduces stress and anxiety. Thus, there is a need for improvement in nurses' kindness in patient care services, as it plays a significant role in providing mental health support to patients.

Additionally, nurses should prioritize showing respect to patients, as it further enhances their well-being. The study also points out that the speaking speed of nurses may be higher due to workload, leading to patients misunderstanding information provided. Language supportiveness is vital as nurses act as intermediaries between doctors and patients, providing treatment and information. Nurses' support in overcoming language barriers and difficulties is highly valued.

*C. Identifying the impact of nurses’ problem-solving ability on the patients’ satisfaction.*

The final objective of this research is to identify the impact of nurses’ problem-solving ability on the patients’ satisfaction. Nurses are much involved in problem-solving activities in various scenarios. Though nurses act as the middle party between doctors and patients, many problems will occur in their day today work. Accordingly, patients are the people who confront difficulties. Therefore, the ability of problem-solving nurses will have much of an impact on the patient.

The analysis derived two themes to demonstrate the content as follows;

Table 3: Themes pertaining identify the impact of nurses’ problem solving ability on the patients’ satisfaction

<b>The way of keeping interpersonal relationship with patients</b>	<b>Availability of knowledge</b>
Human Skills Being flexible	Energetic in-patient care duties Applying knowledge

Source: (Authors)



### 1) Theme 1: The way of keeping interpersonal relationship with patients

Empathy, trust, and open communication characterise the interpersonal bond between nurses and patients. Patients depend on nurses' knowledge and compassion while receiving care, support, and advocacy from them. This connection encourages recovery, comfort, and a satisfying medical experience for the patient.

#### 1) *Human Skills*

The interpersonal relationship between nurses and patients significantly relies on the application of human skills. Nurses utilize their abilities to understand, influence, and guide the behaviour of patients. Effective communication, coordination, motivation, and the formation of a cohesive bond contribute to a successful nurse-patient interaction.

“Usually, I don't like to get medicine. But due to continues pain in my arms and legs, I went to the hospital and get access to the monthly clinic. Nurses are very friendly and they coordinated me to get my medicine correctly”. (Interviewee 09)

#### 2) *Being flexible*

Patients expect flexibility of the nursing care through responding to patient requirements individually, altering their care strategy accordingly, etc. Generally, nurses are supposed to put patients' choices first, deal with unforeseen circumstances and stay adaptable to changing healthcare needs to ensure the best and most individualised care to the patients.

The analysis shows that 22 out of 35 patients were not in positive mind relating to the flexibility in nursing care.

“I requested a nurse to give me pain killers, when I went to the clinic due to sudden headache. But the nurse said that they are prohibited to give any medicine without the doctor's permission. And the doctor was late a few hours, and she did not ask from the other doctor as well. So, I was waiting with my pain until the doctor come and give me medicine.”(Interviewee 14)

#### 2) *Theme 2: Availability of knowledge*

Applying knowledge in nursing care services is crucial for providing high-quality patient care. To assess, diagnose, plan, administer, and evaluate treatment, nurses use their clinical judgement, knowledge, and evidence-based practices. Applying this knowledge ensures that patients receive safe, specialized, and high-quality healthcare that is tailored to their requirements. Under two categories this is analysed as follows;

##### a. *Energetic in patients care duties*

This is referring to nurses' commitment in patient care duties energetically by actively participating in all aspects

of care delivery. This is referring to nurses' commitment in patient care duties energetically by actively participating in all aspects of care delivery. Patients anticipate nurses to engage patient care duties as quick as possible. During the data collection 20 out of 35 showed positive attitudes towards nurses' energetic engagement.

“When I suddenly felt like faint, there was male supporting staff, he also could not be able to hold me and keep on the bed. But young lady nurse was there she quickly attend to me and fixed my bed properly.” (Interviewee 16)

“That nurse quickly did her all work without anyone's help. At the same time, she checked my fever; give medicine to the next person and got blood from another one. The main thing is she performed all the work without showing rush, hurry, or anything” (Interviewee 10)

##### b. *Applying knowledge*

In particular, nursing is one of the practical and critical professions since they are interacting with people who are not healthy on real time basis. To be professional, having knowledge is not sufficient, but they should demonstrate the application as well. Almost all the participants to the research evident the satisfactory level relating to the application of knowledge, since they experience it monthly. Followings are the few statements which prove the patients' satisfaction.

“The nurse always checked the expiry date of the medicine before she uses them to clean my wound” (Interviewee 21)

“I was suffering from high fever and headache and vomited many times when I was waiting in the que to the clinic. My husband informed a nurse and she tried to induce vomiting me in many ways. However, it was succussed.” (Interviewee 24)

Based on the findings, it is evident that nurses demonstrate dedication and commitment in patient care duties, actively engaging in all aspects of care delivery, which supports effective problem solving talents. Patients appreciate nurses' energetic approach and the application of their professional knowledge. However, the study highlights a need for improvement in the flexibility of nursing care services.

While nurses excel in demonstrating good human skills towards patients, enhancing flexibility in their approach to care could further enhance patient satisfaction. By addressing this aspect and incorporating problem-solving abilities into their practice, nurses can better adapt to individual patient needs and provide more personalized and effective care.

Overall, the finding emphasizes the importance of nurses' problem-solving abilities in ensuring patient satisfaction and suggests that further attention be given to enhancing flexibility in nursing care services.

#### V. CONCLUSION

The research aimed to understand patient satisfaction with the quality of nursing care in the government medical sector, specifically in the Ratmalana area. It identified a gap in the literature regarding patient satisfaction with nursing care. The study had three objectives: understanding patient satisfaction with nurses' service, identifying the impact of nurses' personal qualities on patient satisfaction, and assessing the impact of nurses' problem-solving ability on patient satisfaction.

The findings revealed that nurses play a crucial role in providing professional service to patients, but improvements are needed in terms of compassion and meeting patient expectations. Maintaining cleanliness was identified as a key aspect due to the high risk of infections, although challenges were faced in terms of waiting for supplies and variations in support staff's service delivery. Politeness and kindness in nurse-patient communication were found to be crucial, as patients felt embarrassed when nurses were impolite. Kindness had a positive impact on patients' mental health, while respecting patients' well-being was also important. It was noted that nurses' speaking speed, influenced by workload, sometimes led to patient misunderstandings. Language supportiveness was vital in overcoming barriers and providing effective care.

The study highlighted the dedication and commitment of nurses in patient care duties, as well as the application of professional knowledge and problem-solving abilities. However, the flexibility of nursing care services needs improvement to further enhance patient satisfaction. Addressing this aspect and integrating problem-solving skills into nursing practice can enable nurses to adapt to individual patient needs and provide more personalized care.

In conclusion, the research underscores the importance of patient satisfaction with nursing care in the government medical sector. It emphasizes the need for compassionate and respectful communication, maintaining cleanliness, addressing language barriers, and enhancing the flexibility and problem-solving abilities of nurses to ensure optimal patient satisfaction and quality care. Further attention and improvements in these areas will contribute to enhancing the overall healthcare experience for patients.

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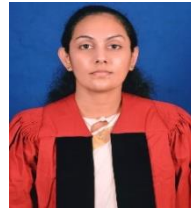
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# Hyperousiology of Nāgārjunian Philosophy: A Hermeneutical Reading

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**Abstract** - Nāgārjuna (ca. 150–250 CE) was a Buddhist philosopher and the founder of the *Mādhyamaka* school of Mahāyāna Buddhism. His philosophy is based on the Buddhist theory of 'dependent origination' (*pratitya-samutpada*) and its stance is that whatever exists, exists as being dependent on its causes and conditions. Nāgārjuna in his doctrine negates all positive claims. The main research problem addressed in this study is whether Nagarjunian negation establishes hyperousious. The research methodology employed in this paper is Hermeneutics. Particularly, Gadamerian hermeneutics is used in this study and reading in an open and inclusive character is protected. The understanding is taken as historical and a fusion of past and present horizons. When reading Śūnyatā philosophy of Nāgārjuna the notions of tradition and prejudice have also been considered in a Gadamerian sense. Negating propositional, linguistic or logical claims on the ultimate reality, Nirvāṇa, the Absolute, *Paramartha*, the Supreme reality, Nāgārjuna says in the *Mula-Madhyamika-karika* in *Atma Pariksha* that independently realized peaceful, un-obsessed *Nirvāṇa* is *Aparapratyayam*: the experience which cannot be imparted to any one by another. It has to be realized by everyone for oneself. It is *shantam*: it is an attitude unaffected by the empirical mind. Nāgārjuna reaches this teleological stance of Nirvāṇa through ultimate negation (*sarva drishti prahanaya yah saddharmam adeshayet*). When analyzing claims on Nāgārjuna's Nirvāṇa, it is something ultimately negated, cannot be hypostasized, but it is affirmed as hyperousious. The conclusion is that Nāgārjuna's philosophy is an attempt at establishing a "superessentiality". This can also be identified as *causa sui* within the horizon of beings and remain as a 'beyond' being, a nonbeing (non-thing).

**Keywords:** Nāgārjuna , Hyperousious Nirvāṇa, Mādhyamaka, Śūnyatā

## I. INTRODUCTION

Nāgārjuna, often referred to as "the second Buddha", is a Buddhist philosopher who founded the Mādhyamaka School; one of the two principal schools of Mahāyāna Buddhism. Nāgārjuna's philosophy is fixed on the "middle way" in the early form Buddhism and hence, it has been popularly known as the Madhyamaka tradition of Buddhism where much emphasis given on the śūnyatā or emptiness of all phenomena in the world. The śūnyatā philosophy has weighted influence not only in the oriental world but also in the occidental spheres as the Mahayana

traditions were spreading via different means particularly through the Jesuit priests who explored the place like India, Tibet and China (Ruegg, 1981). Currently, the philosophy of Nāgārjuna has become an indispensable part of philosophical inquiries pertaining to metaphysics both in the East and the West.

Nāgārjuna's magnum opus is the Fundamental Wisdom of the Middle Way or Mūlamadhyamakakārikā and is considered to be the central text of the Madhyamaka tradition. It consists of 450 stanzas and expounds the entire compass of Nāgārjunian thought (Kalupahana, 1991). . The Sixty Stanzas on Reasoning or Yuktiṣāṣṭikā has also been identified as one of major works of Nāgārjuna and through that work as well he explicates his śūnyatā philosophy while giving emphasis on the notions of emptiness and the idea of dependent origination or pratityasamutpāda. The Seventy Stanzas on Emptiness or Śūnyatāsaptati is also bagged to the account of Nāgārjuna by many scholars and the short treatise is basically on the questions of agency and the two truths connected with the śūnyatā philosophy. The Dispeller of Disputes or Vighrahavyāvartanī authored by Nāgārjuna is considered as an autocommentary to his central philosophy and can be counted as a work as a further explication of the ideas in Mūlamadhyamakakārikā. Nāgārjuna, in this prose style work, makes a great attempt to respond to his philosophical rivals and refute certain substantial ideas that denounced philosophical arguments pertaining to śūnyatā. In this treaty, Nāgārjuna addresses both the Buddhist and non-Buddhist opponents.

Lindtner (1982) identifies the corpus of work that can definitely be attributed to Nāgārjuna:

- *Mūlamadhyamaka-kārikā* (Fundamental Verses of the Middle Way, MMK), available in three Sanskrit manuscripts and numerous translations.
- *Śūnyatāsaptati* (Seventy Verses on Emptiness), accompanied by a prose commentary ascribed to Nagarjuna himself.
- *Vighrahavyāvartanī* (The End of Disputes).
- *Vaidalyaprakarāṇa* (Pulverizing the Categories), a prose work critiquing the categories used by Indian Nyaya philosophy.
- *Vyavahārasiddhi* (Proof of Convention).
- *Yuktiṣāṣṭika* (Sixty Verses on Reasoning).

- *Catuḥstava* (Four Hymns): *Lokāṭīta-stava* (Hymn to transcendence), *Nirāupāmya-stava* (to the Peerless), *Acintya-stava* (to the Inconceivable), and *Paramārtha-stava* (to Ultimate Truth).
- *Ratnāvalī* (Precious Garland), subtitled (rajaparikatha), a discourse addressed to an Indian king (possibly a *Satavahana* monarch).
- *Pratīyasamutpādahṛdayakārika* (Verses on the heart of Dependent Arising), along with a short commentary (Vyākhyāna).
- *Sūtrasamuccaya*, an anthology of various sutra passages.
- *Bodhicittavivaraṇa* (Exposition of the awakening mind).
- *Suḥṛllekha* (Letter to a Good Friend).
- *Bodhisambhārasāstra* (Requisites of awakening), a work the path of the Bodhisattva and paramitas, it is quoted by *Candrakīrti* in his commentary on Aryadeva's four hundred.

There are also some other works attributed to Nāgārjuna, but scholarly debates are there on the authorship of them. For instance, some see texts like *Mahāyānavimsika*, *Bodhicittotpādaśāstra*, *Dvadasakāranayastotra*, *Bhavasamkrānti*, *Sālistambakārikā*, *Stutyitastava*, *Cittavajrastava*, *Mulasarvāstivādisrāmanerakārikā* are attributed to Nāgārjuna.

The Mādhyamaka School rejected the existence of an eternal self and inherently existent phenomena and therefore it was also called *nissvabhava-vada*. The name *nissvabhava-vada* has been accorded for the doctrine due to its proclamation on interdependent origination (*pratīyasamutpada*) or all-conditionality. The Mādhyamaka School believes that everything is empty of self-nature; thus the ego (*puḍgala*), is 'no more than a transitory and changeable empirical personality put together from the five aggregates (*skandhas*)' (Kalupahana, 1976). Various causes and conditions produce phenomena and they all are empty of any inherent existence; everything is related. Nāgārjuna claims that emptiness itself is empty. The ultimate truth, Nirvāṇa is something that has no abandonment, no attainment, no annihilation, no eternality, no cessation, no arising: that transcends dualistic language and conceptual thought. The liberating experience of meditation or therapeutic endeavor uncovers ultimate truth and destroys all attachment to spurious conceptions of the self and the world. It is argued in this paper that Mādhyamaka philosophy operates through denegations and it affirms a super-being hyperousious. Hyperousiology affirms hyperessence and the unsaying or the ineffable is safeguarded (Caputo, 1999). Nirvāṇa as depicted by Nāgārjuna accepts limits of language and makes an attempt to overcome the boundaries of comprehension and translatability through its therapeutic *atakkavacara* doctrine (Della Santina, 1986). Hence, it

embodies a hyper-movement and becomes apophatic that is self-sufficient (Caputo, 1997). This doctrine of absence is a higher apophasis that overcomes both affirmation and negation.

## II. METHODOLOGY

The research methodology employed in this paper is Hermeneutics. Particularly, Gadamerian hermeneutics is used in this study and reading in an open and inclusive character is protected. The understanding is taken as historical and a fusion of past and present horizons. When reading Śūnyatā philosophy of Nāgārjuna the notions of tradition and prejudice have also been considered in a Gadamerian sense. Hermeneutics used here to interpret the purpose or meaning of existence and ultimate reality.

## III. RESULTS/DISCUSSIONS

Nāgārjuna offering a severe criticism over substantialist claims of reality both by Brahminical and Buddhist philosophy, put forward a theory of knowledge, and a new approach to understand ultimate reality of the world with the strategy of *reductio ad absurdum*, that seeks to establish a contention by gleaming an absurdity from its denial, as T.V.R. Murti claims a game of "Jujutsu" (Murti, 2013). Accordingly, the existence of stable substances, the linear and one-directional movement of causation, the atomic individuality of the being, the fixed identity and ego, and dichotomized moral claims like good and evil, etc. are denounced and refuted by the Mādhyamaka philosophy. But in nihilism a kind of characteristics can be identified that are identical to the Śūnyatā philosophy of Madhayamaka tradition as most of nihilist philosophers popularly claim "everything is meaningless" But when it comes to Madhayaka teaching values and meanings to be placed on people, objects, and life will never be compromised to the early tradition of Buddhism and that oral life is negatively affirmed through ultimate negation (Ruegg, 1981).

Hence, the insight of emptiness does not mean "non-existence" or "nihility" and ontologically the ultimate reality of Nirvāṇa is affirmed to safeguard to the moral grounding (Westerhoff, 2009). Rather, Nāgārjuna's mission is to philosophically depict the lack of autonomous existence. Śūnyatā philosophy's entire voyage is to confirm the ultimate reality of Nirvāṇa, that is independently realized, peaceful, un-obsessed by obsessions, without discriminations and a variety of meanings ("*apara pratyayam santam prapancair aprapaeitam nirvikalpam ananartham etat tatt vasya laksanam*") is beyond all the categories (Kalupahana, 1991). Hence, the final teleological destination of Mādhyamaka is beyond all the divisions of real and unreal, being and non-being.

Nāgārjuna refutes intrinsic nature of the world by claiming, *yadi sarvadharmāṇāṃ svabhāva na bhavet tatrāpi niḥsvabhāva bhavet* and then, nominal effect of claiming the absence as well refuted to prevent absence claim another ontological ground as he says *niḥsvabhāva* would not be another metaphysical claim (*tatra niḥsvabhāva ity evam namāni na bhavet*) (Murti, 2013). Though Nāgārjuna defends his skepticism by insisting that he affirms no proposition paradoxicality arises can only be quelled by affirming therapeutic attainment of Nirvāṇa. By doing so Nāgārjuna would protect his doctrine from the fallacy of absolute relativism and the truth of Śūnyatā is safeguarded through the Mādhyamaka sorteriology itself.

Hence, Mādhyamaka doctrine can be understood as a discourse of presence. It promises union with Nirvāṇa, a teleological fulfilment of presence that becomes ontological in an apophatic approach (Marion, 2002). Nirvāṇa that disqualifies all concepts and intentions exceeds knowledge and precedes being; resulting in a super being.

#### IV. CONCLUSION

Nagajuna's Mādhyamaka philosophy makes an attempt to secure some "superessentiality" by adhering his relativist approach to reality to Nirvāṇa and moral philosophy of early Buddhism. Hence, Mādhyamaka mission is an inquiry into the highest or most excellent being or purest being; super-being, a realm of hyperousiology. Nirvāṇa would be the Other as *tout autre*, absence. This can also be identified as *causa sui* within the horizon of beings and remain as a 'beyond' being, a nonbeing (non-thing). Nāgārjuna's Nirvāṇa cannot be hypostasized, but it is affirmed as hyperousious. This teleological fulfillment is more ontological with some superessentiality than just apophatic. The hyperphoton of Nirvāṇa leads to grasping of essence beyond the conceptualization, where intellect will go to silence completely, since it will finally be at one with "something" which is indescribable or ineffable. Hyperousious of the Nagarjunian philosophy goes beyond affirmation and negation and transcends all sorts of reason, philosophy and metaphysics. The layman will have to engage in the destitution of hyperousious and Nirvāṇa will be a therapeutic experience that can be reached in the horizon of presence, a super-being, a hyper-discourse.

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# Towards the Conceptualization and the Operationalization of the Construct of Occupational Stress

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**Abstract**— Occupational stress is a prominent risk factor amongst adversely affecting job interrelated factors midst employees of diverse global industrial contexts. The purpose of this study is to afford a comprehensive conceptualization and operationalization of the construct of occupational stress while developing a complete measuring instrument. The archival method was adopted in this research. The systematic review together with critical review processes have encircled published research articles between 1872 and 2020 in the arenas of HRM, psychology, and organizational behaviour. Accordingly, 126 articles were initially scrutinized, and 96 were systematically reviewed. Thus, “Occupational Stress” can be defined as the employee’s responsiveness of personal dysfunction as a result of perceived workplace conditions and harmful physiological, psychological and emotional responses caused by these uncomfortable workplace conditions. Accordingly, six main dimensions namely, “Responsibility Pressure”, “Quality Concern”, “Role Conflict”, “Job Vs Non-Job Conflict”, “Workload” and “Employee Dysfunction Responses” have been recognized for the construct of “Occupational Stress”. Along with, the explored dimensions, elements, and question items could be utilized to develop a comprehensive instrument to measure the construct of “Occupational Stress”. This study is limited to instrument development; nevertheless, there is an enormous scope for utilizing the instrument to empirically measure occupational stress linked to diverse global industrial contexts in future studies.

**Keywords**— Conceptualization, Instrument, Occupational stress, Operationalization, Stress

## I. INTRODUCTION

The concept of “Occupational Stress” is considered as a prominent risk factor amongst adversely affecting job interrelated factors midst employees of diverse global industrial contexts, who are massively pressurized on their

job results and embraced physically and mentally in coping with their job role as well as workload. Hence, occupational stress has become a prime concern not only amongst the employees but also amongst the HR practitioners in global business industrial contexts as well as research scholars who have engaged in diverse research studies (Chinyere and Ezinwanyi, 2016; Agyei et al., 2019). Execrably, global economic recession, constant technological changes, managerial attitudes along with corrupt competitive work environments have primarily contributed to stressful work environments linked to diverse global business industrial contexts (Colligan and Higgins, 2006; Dartey-Baah et al., 2020). Nevertheless, work life plays a dominant role among most of the individuals which springs happiness, well-being, and sound health, nonetheless it generates a potential source of stress too. Conferring to Jain and Batra (2015) occupational stress makes employees dread walking hooked on their workplace every morning, then makes them burden on their jobs during every night. Conversely, occupational stress affords stimulations, challenges, growth, development while providing an excitement for the life also (Selye, 1956). Besides, occupational stress leads to destructive and detrimental consequences primarily on employees’ well-being and organizational productivity, if it is not properly managed (Agyei et al., 2019). Consequently, the negative impacts on both the employees and the organizations are several ill-health conditions, obligatory early retirement, poor performance, job dissatisfaction, insufficient employee relations, accident vulnerability, alcohol addict, frequent absenteeism, high labor turnover, and so on (Cooper and Davidson, 1982). Characteristically, employees are obligatory to perform diverse tasks, learn novel skills as well as entail meeting organizational competitive demands (Dollard et al., 2003). Therefore, these conditions lead for more fluid jobs, role ambiguity and role conflict in the jobs while revolving occupational stress (Dollard et al., 2003). Through this view, there are three main objectives in this conceptual study. The first objective is to establish a novel



practical definition for occupational stress. Afterwards, the second objective is to explore different dimensions and their elements for the core variable of occupational stress. Finally, the third objective is to develop a comprehensive instrument in measuring the construct of occupational stress.

## II. LITERATURE REVIEW

This section provides a brief explanation of the development of the concept of “Occupational Stress” grounded on prior research findings. In consort with, it further affords a comprehensive review of “Occupational Stress” definitions specified by enormous scholars in the arenas of HRM, psychology, medicine, engineering, and organizational behavior.

### L. Evolution of the Concept of “Occupational Stress”

Conferring to Selye (1973) the concept of “Stress” is very ancient and it must have arisen even to pre-historic man that the loss of vigour as well as feeling of exhaustion. Initially, Claude Bernard (1813-1878) expressively contributed towards development of “Stress” through his established concept of ability of an organism in maintaining a persistent fluid environment bathing cells of the body so-called “milica interieur” (Bernard, 1872). Nevertheless, around 50 years later Walter Cannon (1871-1945) consequently coined “homeostasis” through his research series in describing the maintenance in acceptable ranges of numerous physiological variables. Henceforth, Walter Cannon used “Stress” in describing the emotional states which had potential detrimental physical outcomes on organisms. Although Walter Cannon (1871-1945) and Hans Selye (1907-1982) rarely mentioned the terms “Occupational Stress” or “Work related Stress”, their research not ever focused on it, certainly their revolutionary works have been performed with the animals and not with the people (Ivancevich and Ganster, 2014). Nevertheless, the concept of “Occupational Stress” perhaps can be traced through the non-experimental studies performed in early 1960s with the American employees (Kahn et al., 1964). Further, Kahn et al. (1964) have estimated one third or more employees in their national sample were highly experiencing the phenomenon called “Occupational Stress”.

Furthermore, from the point of view of experimental psychology and engineering psychology an entirely dissimilar approach to “Occupational Stress” had been initiated by the previous researchers (Ivancevich and Ganster, 2014). In view of that, according to Broadbent (1954) the physical stressors such as noise had been studied for their effects on the job performances. Currently, there are four distinguishable approaches to “Occupational Stress”, namely medical approach, clinical psychology approach, engineering psychology approach and organizational psychology approach (Ivancevich and

Ganster, 2014). Four approaches to “Occupational Stress” are diagrammatically depicted (Figure 1).

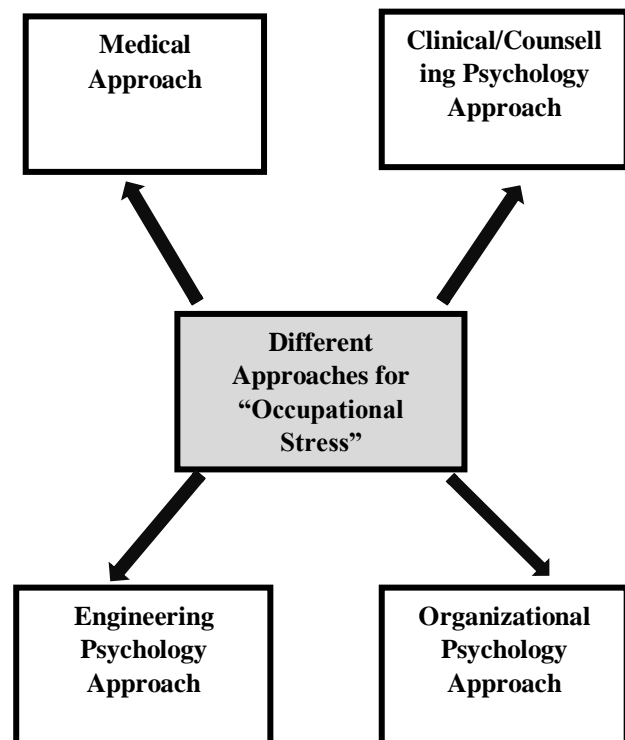


Figure 1. Key four approaches to occupational stress  
Source: Developed by researchers based on literature

Initially, the medical approach obviously has its historical roots in the tradition of Walter Cannon (1871-1945) and Hans Selye (1907-1982). At that juncture, the psychological approaches to “Occupational Stress” are closely parallel to the medical approach, but it emphasizes psychological causes and consequences instead of the physical causes (Ivancevich and Ganster, 2014). Then, the engineering psychology approach has traditionally focused on physical characteristics of workplace as stressors as well as on job performance as the primary out-come (Ivancevich and Ganster, 2014). Moreover, in the organizational psychology approach, the psychological stressors are found to influence psychological strains in the organizational psychology approach and workplace characteristics are the targets for the direct treatments (Ivancevich and Ganster, 2014). Likewise, this particular approach, receiving pioneering impulse through the book written by Kahn et al. (1964) which was developed with a precise interest in the workplace stress. As a prominent indication of the discrete development of these approaches, Kahn et al. (1964) has identified as a classic from organizational psychology approach, even referencing Hans Selye (1907-1982) in his prominent published book, nevertheless Hans Selye is given the credit as a pioneer in medical and clinical/counseling psychology approaches (McLean, 1979; Ivancevich and Ganster, 2014).

### *M. Review of “Occupational Stress” Definitions*

Throughout the research history several scholars have defined the term entitled, “Occupational Stress” conferring to numerous viewpoints. Since, there are key approaches to occupational stress namely, medical approach, clinical psychology approach, engineering psychology approach and organizational psychology approach, the concept of “Occupational Stress” has been defined in diverse ways based on these key approaches in various circumstances while acquiring key features of these approaches. Hence, Walter Cannon (1871-1945) and Hans Selye (1907-1982) have described “Stress” based on key features of medical approach, which is also being applied for the workplace settings, but was not developed from a primary interest in occupations or the workplace (Ivancevich and Ganster, 2014). In addition, the medical approach tends to focus on the individual more than on the organization (Ivancevich and Ganster, 2014). Accordingly, Selye (1956), who is a pioneer of occupational stress has defined “Stress” as a state manifested by a specific syndrome which consists of all the non-specific changes within the biologic system that occur when challenged by aversive or noxious stimuli. Conferring to Selye (1956) stress is typically treated as a generalized as well as nonspecific physiological response syndrome. Far ahead, Forman and Myers (1987) defined “Stress” as the body’s physical, mental, and chemical reaction to stressors or circumstances that frighten, excite, endanger, confuse, challenge, surprise, anger or irritate for instance unrealistic job deadlines, financial strain, or broken relationships. According to them, stress causing stressors may be occurred due to various circumstances related to personal life, academic life, career life and so on. Conferring to the physiological approach, the concept of stress is a specific physiological response to a threatening or else damaging environment (Cox et al., 2000). Accordingly, Cox et al. (2000) defined “Stress” as the common physiological effects of a wide range of aversive or noxious stimuli. Thus, Cox et al.’s (2000) definition which is based on the physiological approach only focused upon the physiological effects of the individual.

In consort with, Beehr and Newman (1978) defined the concept of “Occupational Stress” as a situation where in job related factors interact with a worker to change his or her psychological and/or physiological condition and this forces the person to deviate from his or her normal functioning. Thus, when the organizational staff is unhappy, they are less efficient and effective as well as more probable to squander work hours or else ultimately quit (Beehr and Newman, 1978). Subsequently, the occupational stress affects not only the morale of the employees, but also the organization’s bottom line (Beehr and Newman, 1978). Additionally, Beehr and Newman (1978) emphasize the interacting nature of job-related factors with employees in causing stress, while

highlighting both the physiological as well as psychological changes of the employees in the organizational settings. After around a decade of period Leiter and Maslach (1988) defined “Occupational Stress” as depersonalization, emotional exhaustion as well as a reduced sense of personal accomplishment, while mentioning that, there is no universally agreed definition for this concept. In consort with, conferring to the United States National Institute for Occupational Safety and Health (USNIOSH) (1999) “Occupational Stress” can be defined as the harmful physical and emotional responses that occur when the requirements of the job do not match the capabilities, resources or else needs of the worker. Thus, prolonged distress is more destructive to physical, mental as well as emotional health of professionals under numerous circumstances (De Silva et al., 2017). Therefore, unnecessary occupational stress affects with the individual performance, organizational productivity as well as efficiency of overall project delivery (De Silva et al., 2017).

Subsequently, Kyriacou (2001) also defined the concept of “Occupational Stress” as the unpleasant, negative emotions, such as anger, anxiety, tension, frustration, or depression, resulting from some aspect of the work as an employee (pp. 28). However, this definition has been precisely targeted upon the teaching profession. Hence, the employee’s emotions are probable to impact on his or her performance in the organization (Kyriacou, 2001). In consort with, Tsai et al. (2009) also defined the concept of “Occupational Stress” as harmful physical and emotional responses incurred in the work environment. Hence, Tsai et al.’s (2009) definition incorporates both physical and emotional responses with respect to diverse occupational stressors prevailing in the organizational work settings.

Along with, Langan-Fox and Poole (1995) defined the concept of “Occupational Stress” as the imbalance resulting from job-related demands and abilities. However, a certain amount of stress can act as a catalyst for optimum job performance, while too much stress can damage employee’s health and wellbeing during the process of job performance in the organizational setting (Langan-Fox and Poole, 1995). Along with, Montgomery et al. (1996) also defined the concept of “Occupational Stress” as an employee’s awareness or feeling of personal dysfunction, as a result of perceived conditions or happenings in the workplace, and employees’ psychological and physiological reactions caused by these uncomfortable, undesirable or threats in the employee’s immediate workplace environment. In conclusion, different definitions specified by enormous scholars in the arenas of HRM, psychology, medicine, engineering, and organizational behaviour for the notable concept of

“Occupational Stress” are descriptively shown with the comprehensive comments (Table 1).

Table 1. Definitions for the concept of “Occupational Stress”

Author (s) & Year	Definition	Comments
Selye (1956)	Stress is defined as a state manifested by a specific syndrome which consists of all the non-specific changes within the biologic system that occur when challenged by aversive or noxious stimuli.	-Stress occurs when confronted by aversive or noxious stimuli.  -Tends to focus on the individual more than on the organization.
Cox et al. (2000)	Stress is defined as the common physiological effects of a wide range of aversive or noxious stimuli.	-Describes the concept of stress as physiological effects of noxious stimuli.
Beehr and Newman (1978)	Occupational stress is defined as a situation where in job related factors interact with a worker to change his or her psychological and/or physiological condition and this forces the person to deviate from his or her normal functioning.	-Describes the concept of occupational stress as a situation where job related factors interact with workers.  -Describes the changing of both psychological and physiological conditions of the workers.
USNIOSH (1999)	Occupational stress is defined as the harmful physical and emotional responses that occur when the requirements of the job do not match the capabilities, resources or else needs of the worker.	-Describes the harmful physical and emotional responses as a result of occupational stressors.
Montgomery et al. (1996)	Occupational stress is defined as an employee’s awareness or feeling of personal dysfunction, as a result of perceived conditions or happenings in the workplace, and employees’ psychological and physiological reactions caused by	-Describes the employee’s responsiveness of personal dysfunction because of workplace conditions.  -Describes psychological and physiological reactions caused by uncomfortable conditions in the workplace.

	these uncomfortable, undesirable or threats in the employee’s immediate workplace environment.	
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Source: Developed by researchers based on literature

### III. RESEARCH METHODOLOGY

The archival method was adopted by researchers in accomplishing the key objectives of the research. Similar methodological approaches were practiced related to the research arena of occupational stress in prior research history by Fletcher and Payne (1980). The systematic review together with critical review processes were combined in this review in establishing a novel practical definition, conceptualizing, operationalizing, and developing a comprehensive instrument to measure the construct of occupational stress. Conferring to Khan et al. (2003) systematic review is specifically “...based on a clearly formulated questions, identifies relevant studies, appraises their quality, and summarizes the evidence by use of explicit methodology. It is the explicit and systematic approach that distinguishes systematic reviews from traditional reviews and commentaries.” (Khan et al., 2003, pp. 118). Thus, the systematic review process has enclosed published research articles in fields of HRM, psychology, and organizational behaviour, which have been published between 1872 and 2020. In this systematic review process, noteworthy academic research databases so-called, Emerald Insight, Taylor and Francis, JSTOR, Elsevier, Springer, Scopus, Willey Online, PubMed, SAGE Publishing and Science Direct have been utilized for principal collection through published research articles. Furthermore, academic institutional repositories of recognized global universities too have been considered in the meantime for additional collection. In view of that, approximately 126 published research articles were considered and scrutinized in the initial review to check the applicability of them for the research phenomenon. After eliminating irrelevant and duplicates, the remaining 96 published research articles were systematically reviewed. Six key search screening conditions were defined and established to warrant the translucent selection of the published research articles (Table 2). Since the requirement of in-depth exploration of the concept of occupational stress along with its evolution, as well as the availability of a rarer number of studies interrelated to the arena of occupational stress, a wide-ranging period (from 1872 to 2020), was considered as the time window of the study.

Table 2. The key search screening conditions, which were applied for the inclusion and exclusion of published research articles in the systematic review process.

Search screening condition	Reasons for using the search screening condition	Inclusion	Exclusion
Language of the article	To access articles published in the international language, which is most extensively used by researchers.	English language	Any other language other than English language
Format of the article	To analyse and synthesis the presented information in the published research article precisely.	Full text	Abstract only
Type of the article	To concentrate on the quality of the published research article.	Research article published in the scientific peer-reviewed journal	Research article published in non-scientific non peer-reviewed journal, conference proceedings, newspapers, books etc.
Period	To perform an in-depth exploration of core concepts together with their evolutions.	1872-2020	Before 1872
Relevance in terms of research arena of occupational stress	To create a pool of published research articles, which are relevant to occupational stress.	Published research article, which refers to occupational stress.	Published research article, which does not refer to occupational stress.
Relevance in terms of conceptualization, operationalization, and development of the instrument to measure the	To create a pool of published research articles, which are relevant to conceptualization, operationalization, and the development of measuring	Published research article, which refers to conceptualization, operationalization and measuring instrument	Relevance in terms of conceptualization, operationalization, and development of the instrument to measure the

construct of occupational stress.	instrument for occupational stress.	development for occupational stress.	construct of occupational stress.
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Source: Developed by researchers

Subsequently, this research study comprehended a systematic review process that has led to comprehensive conceptualization and operationalization of the construct of occupational stress aimed at developing a comprehensive instrument which is intended to be verified in future research studies both quantitatively and qualitatively.

#### IV. TOWARDS THE CONCEPTUALIZATION OF OCCUPATIONAL STRESS

Throughout the research antiquity several scholars have defined the concept of “Occupational Stress” conferring to numerous viewpoints. Since, there are key approaches to occupational stress namely, medical approach, clinical psychology approach, engineering psychology approach and organizational psychology approach, “Occupational Stress” has been defined in diverse ways based on these key approaches in various circumstances while acquiring the features of these approaches. Selye (1956) has defined “Stress” as a state manifested by a specific syndrome which consists of all the non-specific changes within the biologic system that occur when challenged by aversive or noxious stimuli.

Afterwards, Beehr and Newman (1978) defined “Occupational Stress” as a situation where in job related factors interact with a worker to change his or her psychological and/or physiological condition and this forces the person to deviate from his or her normal functioning. Subsequently, occupational stress affects not only the morale of the employees, but also the organization’s bottom line (Beehr and Newman, 1978). Conferring to USNIOSH (1999) “Occupational Stress” can be defined as the harmful physical and emotional responses that occur when the requirements of the job do not match the capabilities, resources or else needs of the worker. Thus, prolonged distress is more destructive to physical, mental as well as emotional health of professionals under numerous circumstances (De Silva et al., 2017). Along with, Montgomery et al. (1996) also defined “Occupational Stress” as an employee’s awareness or feeling of personal dysfunction, as a result of perceived conditions or happenings in the workplace, and employees’ psychological and physiological reactions caused by these uncomfortable, undesirable or threats in the employee’s immediate workplace environment. To sum up, reviews of occupational stress definitions are descriptively elaborated (Table 1).

*A. Occupational Stress: Working Definition*

The working definition for the concept of “Occupational Stress” was developed based on three noteworthy definitions specified by Beehr and Newman (1978), Montgomery et al. (1996) and USNIOSH (1999).

Accordingly, the developed working definition for the concept of “Occupational Stress” is as follows:

“Occupational Stress is the employee’s responsiveness of personal dysfunction as a result of perceived workplace conditions and harmful physiological, psychological and emotional responses caused by these uncomfortable workplace conditions”.

**V. TOWARDS THE OPERATIONALIZATION OF OCCUPATIONAL STRESS**

Operationalization comprehends translating of psychological world into physical world (Bryman and Bell, 2011). This is performed by observing the behavioural dimensions, facets, or else properties signified by the concept (Sekaran and Bougie, 2016). Thus, dimension is an aspect of a concept (Bryman and Bell, 2011). Consequently, these dimensions are translated into observable and measurable elements in developing an index of measurement of the specific concept (Sekaran and Bougie, 2016). Based on the established working definition for “Occupational Stress” six key dimensions have been identified.

*A. Key Dimensions of Occupational Stress*

“Responsibility Pressure”, “Quality Concern”, “Role Conflict”, “Job Vs Non-Job Conflict”, “Workload” and “Employee Dysfunction Responses” have been recognized as the key dimensions for the construct of “Occupational Stress” in this comprehensive research.

1) *Responsibility Pressure*: Conferring to House et al. (1979) responsibility pressure signifies having excessive responsibility for people, process or else products and inadequate human assistance or material assistance. The first dimension of “Responsibility Pressure” entails four elements namely, “Individual and Subordinate Responsibility”, “Tasks with High-Cost Mistakes”, “Lack of Human Assistance” and “Lack of Material Assistance”. Thus, responsibility pressure is measured by the question items which come under four elements. Accordingly, the element of individual and subordinate responsibility is measured by two question items (Table 3). Afterwards, the element of tasks with high-cost mistakes is measured by one question item (Table 3). Subsequently, the element of lack of human assistance is measured by one question item (Table 3). Along with, the element of lack of material assistance is measured by one question item (Table 3). In

conclusion, Table 3 presents key elements and question items of the dimension so-called “Responsibility Pressure”.

Table 3. Elements and items of the dimension termed “Responsibility Pressure”.

Element	Item
Individual and subordinate responsibility	I have too much individual responsibility.
	I have too my responsibility of my subordinates.
Tasks with high-cost mistakes	I perform tasks where mistakes could be quite costly.
Lack of human assistance	I do not have enough human assistance in performing my job.
Lack of material assistance	I do not have enough material/equipment facilities in performing my job.

Source: House et al., 1979

2) *Quality Concern*: Conferring to House et al. (1979) quality concern designates of having concern about not being able to perform as good work as one could or else should. The second dimension of “Quality Concern” entails three elements namely, “Amount-Quality Interference of Work”, “Tasks against the own Judgment” and “Inability of Influencing Supervisor’s Decisions and Actions”. Thus, quality concern is measured by the question items which come under three elements. Accordingly, the element of amount-quality interference of work is measured by one question item (Table 4). Then, the element of tasks against the own judgment is measured by one question item (Table 4). Along with the element of inability of influencing supervisor’s decisions and actions is measured by one question item (Table 4). In conclusion, Table 4 presents key elements and question items of the dimension so-called “Quality Concern”.

Table 4. Elements and items of the dimension termed “Quality Concern”.

Element	Item
Amount-quality interference of work	I think that the amount of work I have to do may interfere with its quality.
Tasks against the own judgment	I feel that I have to do tasks that are against my better judgment.
Inability of influencing supervisor’s decisions and actions	I feel that I am unable to influence my immediate supervisor’s decisions and actions that affect me.

Source: House et al., 1979

3) *Role Conflict*: Conferring to House et al. (1979) role conflict denotes the receiving of ambiguous and / or

conflicting expectations from the others at work. The third dimension of “Role Conflict” entails three elements namely, “Conflicting Demands of Others”, “Conflicting Expectations” as well as “Satisfying too many People”. Accordingly, role conflict is measured by the question items which come under three elements. Consequently, the element of conflicting demands of others is measured by one question item (Table 5). Then, the element of conflicting expectations is measured by one question item (Table 5). Along with, the element of satisfying too many people is measured by one question item (Table 5). In conclusion, Table 5 presents key elements and question items of the dimension so-called “Role Conflict”.

Table 5. Elements and items of the dimension termed “Role Conflict”

Element	Item
Conflicting demands of others	I am unable to meet the conflicting demands of others work with me.
Conflicting expectations	I don't know what the others expect from me.
Satisfying too many people	I have to satisfy too many people during performing my job.

Source: House et al., 1979

4) *Job Vs Non-Job Conflict*: Conferring to House et al. (1979) Job Vs Non-Job Conflict denotes feeling that the job interferes with nonwork life for instance family life and so on. Typically, in the job Vs non-job relationship the employee needs to manage the interactions and responsibilities between the employment and household efficaciously (Palacio et al., 2022). The fourth dimension of Job Vs Non-Job Conflict entails three elements namely, “Job Interference with Family Life”, “Overtime during Unwanted Hours” as well as “Feeling Trapped”. Accordingly, Job Vs Non-Job Conflict is measured by question items which come under three key elements. Consequently, the element of job interference with family life is measured by one question item. Then, the element of overtime during unwanted hours is measured by one question item. Along with, the element of feeling trapped is measured by one question item. In conclusion, Table 6 presents key elements and the question items of the dimension so-called “Job Vs Non-Job Conflict”.

Table 6. Elements and items of the dimension termed “Job Vs Non-Job Conflict”.

Element	Item
Job interference with family life	I feel that my job tends to interfere with my family life.
Overtime during unwanted hours	I am asked to work overtime when I don't want to.

Feeling trapped	I feel that I am trapped in a job I don't like, but can't out of.
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Source: House et al., 1979

5) *Workload*: Conferring to House et al. (1979) workload denotes reporting a huge quantity of work as well as frequent time pressure. Specific to the IT software service industry, workload refers to the workload which software professionals typically contract with because of the nature of the projects and the project management tasks (Palacio et al., 2022). Moreover, due to too many allocated tasks in a given period of time, the level of occupational stress could be enhanced (Palacio et al., 2022). Accordingly, the employees feel overwhelmed due to the amplified number of tasks which have a negative effect on the employees' perceptions to carry out their jobs, meet deadlines and comply with their duties (Palacio et al., 2022). The fifth dimension of “Workload” entails three elements namely, “Work Very Fast”, “Work Very Hard” as well as “Insufficient Job Accomplishment Time”. Accordingly, the dimension of workload is measured by question items which come under three key elements. Consequently, the element of work very fast is measured by one question item. Then, the element of work very hard is measured by one question item. Along with, the element of insufficient job accomplishment time is measured by one question item. In conclusion, Table 7 presents key elements and the question items of the dimension so-called “Workload”.

Table 7. Elements and items of the dimension termed “Workload”.

Element	Item
Work very fast	I have to work very fast often during performing my job.
Work very hard	I have to work very hard (physically/mentally) during performing my job.
Insufficient job accomplishment time	I feel that my job offers me with little time to get everything done.

Source: House et al., 1979

6) *Employee Dysfunction Responses*: Conferring to Montgomery et al. (1996) employees feel personal dysfunction due to perceived working conditions which leads to diverse employees' psychological and physiological reactions followed by undesirable conditions in immediate workplace environment. Thus, the dimension of “Employee Dysfunction Responses” entails three elements namely, “Physiological Responses”, “Psychological Responses” and “Emotional/Behavioural Responses”. Accordingly, the dimension of employee dysfunction responses is measured by the question items which come under three elements. Thus, the element of physiological responses is measured by four question

items. Then, the element of psychological responses is measured by three question items. Along with, the element of emotional/behavioural responses is measured by four question items. In conclusion, Table 8 presents key elements and the question items of the dimension so-called “Employee Dysfunction Responses”.

Table 8. Elements and items of the dimension termed “Employee Dysfunction Responses”.

Element	Item
Physiological responses	I have elevated levels of blood pressure.
	I have heart pains or cardiovascular disease symptoms.
	I have frequent muscle aches in my body muscles (E.g.: neck aches, back aches, hand aches, leg aches and etc.)
	I have frequent headaches.
Psychological responses	I often feel of being useless and hopeless during performing my job.
	I frequently feel lack of concentration during performing my job.
	I often feel anxiety during performing my job.
Emotional/ Behavioural responses	I have eating disorders for instance; eating too much or eating inadequately.
	I often have sleep disturbances.
	I addict for alcohol, smoking or other drugs.
	I often aggressive during performing this job.

Source: Palacio et al., 2022; Edwards et al., 1998

Accordingly, the construct of “Occupational Stress” comprises six key dimensions namely, “Responsibility Pressure”, “Quality Concern”, “Role Conflict”, “Job Vs Non-Job Conflict”, “Workload” and “Employee Dysfunction Responses”. Key dimensions and the elements of the variable of “Occupational Stress” are diagrammatically displayed (Figure 2). Conferring to figure 2, (D) stands for a “Dimension” and (E) stands for an “Element” of the variable of “Occupational Stress”.

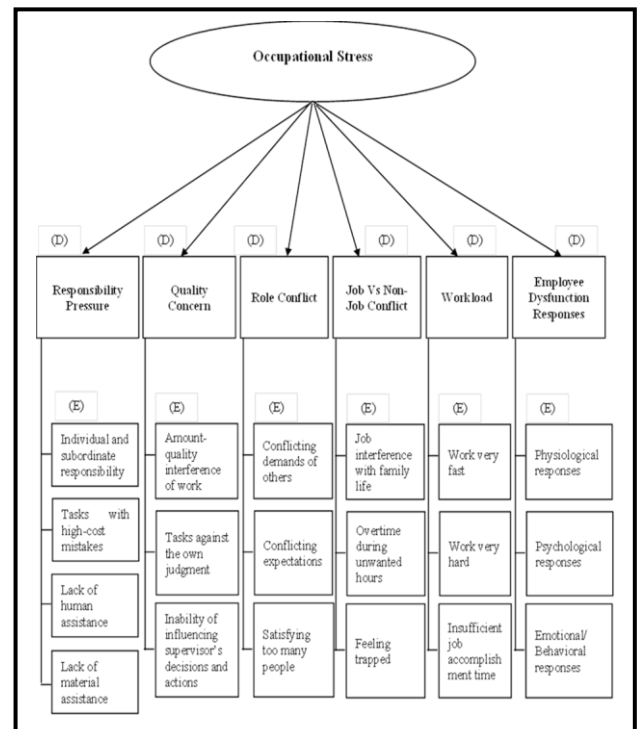


Figure 2. Dimensions and Elements of the Variable of “Occupational Stress”

Source: Beehr and Newman, 1978; Montgomery et al., 1996; USNIOSH, 1999; House et al., 1979

## VI. CONCLUSIONS, LIMITATIONS AND SUGGESTIONS

Occupational Stress is the employee’s responsiveness of personal dysfunction as a result of perceived workplace conditions and harmful physiological, psychological and emotional responses caused by these uncomfortable workplace conditions. Accordingly, six main dimensions namely, “Responsibility Pressure”, “Quality Concern”, “Role Conflict”, “Job Vs Non-Job Conflict”, “Workload” and “Employee Dysfunction Responses” have been recognized for the construct of “Occupational Stress”. Relevant certain elements under each dimension have been explored through this comprehensive research. In conclusion, the explored dimensions, elements, and question items could be utilized to develop a comprehensive instrument to measure the construct of “Occupational Stress”.

This research study is limited to instrument development in measuring the construct of “Occupational Stress”, nevertheless, there is an enormous scope for utilizing this developed comprehensive instrument to empirically measure the construct of “Occupational Stress” linked to employees’ perspectives. Accordingly, the developed instrument could be utilized to measure the employee perceived occupational stress discretely or accompanying with another construct linked to diverse global business industrial contexts after having a comprehensive reliability and validity assessments linked to such specific contexts in future studies. Correspondingly, the developed instrument



could be applied for the future comparative research studies in measuring the different perceived occupational stress levels among the employees under diverse designation categories or diverse hierarchical levels linked to numerous global business industrial contexts. A significant knowledge can be engendered into the knowledge pool of HRM, psychology, medicine, engineering, and organizational behaviour through introducing of a novel practical definition for occupational stress, its dimensions as well as a pragmatic comprehensive instrument to measure it.

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# Effectiveness of Progressive Muscle Relaxation in managing Adjustment Disorder among apparel sector employees in Sri Lanka

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**Abstract**— The apparel sector takes place among the largest industries in Sri Lanka, occupying 15% of the country's labour force. The target-oriented nature of the apparel sector often requires employees to work under pressure for extensive hours. Hence, work-related stress is highly prevalent among apparel sector employees, hindering their mental well-being. Adjustment Disorder (AjD) is one such health problem faced by employees in work settings where higher efficiency and productivity are expected within limited time frames. Progressive Muscle Relaxation (PMR), a widely-used tool for the effective management of stress-related disorders, including AjD. However, no studies have been conducted on using PMR to manage AjD in Sri Lanka. Therefore, this study aims at exploring the effectiveness of PMR in managing AjD among apparel sector employees in Sri Lanka. A quasi-experimental design was employed, with 91 participants being allocated to the experimental (n=45) and control group (n=46). The intervention consisted of PMR exercises conducted over 8 weeks. PMR and control groups completed the Adjustment Disorder-New Module 20 (ADNM-20) questionnaire at baseline and after the intervention period. Wilcoxon signed-rank tests revealed that the PMR group elicited a statistically significant decrease in mean ADNM-20 scores from pre-intervention to post-intervention ( $p=0.03$ ), while the control group elicited a significant increase in mean scores ( $p<0.001$ ). The significant reduction in ADNM-20 scores following the intervention in the experimental group demonstrates the efficacy of PMR in managing AjD. Extensive studies are required to assess the practicability of using PMR as the gold standard for treating AjD.

**Keywords**— Apparel sector, Adjustment Disorder, PMR, ADNM-20

## I. INTRODUCTION

Therapeutic intervention is a psychological effort to help individuals to improve their ability to adhere and cope with dynamic instances of life, to benefit from pharmacological treatments and to improve the quality of life. Relaxation practices are therapeutic exercises that support people in reducing their blood pressure, anxiety levels, stress levels and difficulty levels. According to Zelviene and

Kazlauskas (2018), Adjustment Disorder is a stress-related disorder that is rather frequent, especially in several occupational settings (Chirico, 2016), such as the garment sector, which has a substantial workforce and is important to the Sri Lankan economy.

More significantly, AjD can substantially reduce worker productivity (O'Donnell *et al.*, 2019), posing potential health risks that have an immediate negative impact on a country's capacity to develop economically. This paper describes a single segment of a PhD research on the impacts of Progressive Muscle Relaxation (PMR) in managing Adjustment Disorder among apparel sector employees in Sri Lanka.

### A. Therapeutic intervention in counselling

There are several counselling-related therapies provided globally, where by the 1900s psychology and counselling saw the intervention of behaviour therapy through numerous researchers like Ivan Pavlov, B. Watson, Skinner, and others. Additionally, PMR was introduced to physiology by Edmund Jacobson in 1920 and applied in psychology to reduce stress (Mackereth, 2010). Furthermore, in 1950, Albert Ellis established the cognitive therapeutic intervention in counselling. Aron Beck (1960) combined cognitive therapy with behavioral therapy to produce Cognitive Behavioral Therapy (CBT), a type of psychology/counselling (Liu *et al.*, 2020).

Subsequently, when studying the specifics of therapeutic interventions, it is described as it is possible to apply many therapeutic methods in a variety of settings and with various formats. In the psychology setting, the phrase refers to actions or routines that improve another person's mental, social, or emotional health. Counselling sessions might be brief, lengthy, or endless depending on the requirements of the client (Ng *et al.*, 2007). Counsellors establish trustworthy working connections with their clients by being present with them while also paying close attention to and empathetically listening to them (Macdonald *et al.*, 2016). Over time, counselling therapeutic approaches have changed, and they now incorporate a variety of philosophies. Its purpose is to

change a person's mental processes by supporting them in understanding detrimental thought processes and the behaviours that go along with them in stressful situations. It is advised for mild to moderate mental and behavioural issues.

Marsha Linehan created Dialectical Behavioural Therapy (DBT), an emotional intensity-focused talking therapy, based on CBT, in the early 1970s (Eva et al., 2022). It seeks to help people in embracing and understanding their feelings, learn techniques for coping, and attempt to make positive changes. DBT is now the treatment of choice for persons with borderline personality disorder (BPD) due to a lack of knowledge and the fact that it is most frequently employed with women. Simple Relaxation (SR) is a common approach used in therapy to lower stress, anxiety, bloodpressure and discomfort. It can help to create pleasant visions when used with guided imagery and meditation. It has been demonstrated that employing SR therapy is an effective way to treat depression, stress, anxiety, and phobias.

### *B. Progressive Muscle Relaxations*

Progressive muscle relaxation (PMR), a technique developed by Edmund Jacobson for a deep relaxation of muscles in 1920s (Mackereth, 2010), which is particularly impactful in reducing the negative symptoms of depression, stress, and anxiety (Gangadharan, 2018; Kapogiannis et al., 2018; Liu et al., 2020). In research evaluating the effectiveness of PMR and Guided Imagery on the intensity of diabetic peripheral neuropathic pain, exhaustion, and quality of life among type 2 diabetes mellitus patients, both therapies produced favourable effects on the pain (Izgu et al., 2020). Additionally, PMR was proven to be successful in reducing the negative effects of nausea and improving the mental health of cancer patients. In research including men with prostate cancer, PMR was identified to improve the overall health-related quality of life by reducing blood pressure, heart rate, muscular tension, and breathing rate (Isa et al., 2013). PMR has been used to treat AjD in addition to being useful in managing anxiety, depression, sleep disorders, and other behavioural problems and it has been deoicted to be effective in counselling interventions, particularly to reduce anxiety, stress, and depression. Through the use of several strategies, it may be made even more successful in controlling different behavioural problems and reducing anxiety.

### *C. Adjustment Disorder*

Adjustment Disorder (AjD) is a condition characterized by an unhealthy emotional and behavioral reaction to a specific psychosocial stressor. It typically impacts people

who struggle to adjust with the effects of a stressful event in a way that seems more intense or severe than the actual stressor itself (O'Donnell et al., 2019). It is recognized as a stress-related disorder and is the most common psychological disorder in therapeutic settings (Zelviene and Kazlauskas, 2018). Although AjD has been recognized in significant diagnosis symptoms for more than 50 years (Zelviene and Kazlauskas, 2018), the diagnostic criteria for AjD are still unreliable, presenting challenges for mental health providers. Different aetiologies, including both beneficial and detrimental conditions, could lead to AjD. Depending on the importance of the triggering incident and its significance, symptoms could range from moderate to severe.

Healthcare professionals use the 5<sup>th</sup> Edition, Diagnostic and Statistical Manual of Mental Disorders (DSM-5) and the 11<sup>th</sup> Edition, International Classification of Diseases (ICD-11) (World Health Organization, 2018) to diagnose AjD, a Trauma and Stressor-Related Disorder. These classifications are based on exclusion standards and influence therapeutic actions and research. AjD is classified under the ICD-11 and the DSM-5. The first diagnosis was established using DSM criteria, despite similarities as AjD is a psychological disorder.

The DSM classifications' definitions and diagnoses of AjD have gone through some changes; initially, in DSM-1, AjD was referred to as a "transient situational personality disorder," which was later renamed as "transient situational disturbances" in DSM-II (Carta et al., 2009). Following that, DSM-III first used the term "Adjustment Disorder" in the setting of mental health while, DSM-IV expanded on its symptoms. The American Psychiatric Association (2013) (APA) indicates that the DSM-5's most recent edition includes five-point criteria for the diagnosis of adjustment disorder. As a result, an individual may be diagnosed with AjD if they show emotional and behavioural symptoms that are out of proportion to the severity of one or more identifiable stressors and/or show significant changes in several functional areas of life such as social and occupational within three (03) months of experiencing the stressor. Additionally, it states that the symptoms mentioned above must cease within six (06) months after the stressor has passed and that the event related to the stress shouldn't meet the criteria of any other mental disorder or act as an extension for an already existing mental disorder. The DSM-5 includes six (06) subgroups of AjD based on the primary symptoms described. The following includes a list of each subtype's most typical symptoms: subtype-1) AjD with depressive symptoms, subtype-2) AjD with anxious symptoms, subtype-3) AjD with a mix of both depressive and anxious symptoms, subtype-4) AjD with disturbances of conduct, subtype-5) AjD with disturbances of conduct and

emotions, and subtype-6) AjD unspecified, individuals identified as adjustment disorder unspecified have symptoms which doesn't resemble the other types of adjustment disorder.

Every person experiences various stresses at some point during their lifetime. Though most people can deal with stress, AjD symptoms might sometimes occur in some individuals. Instead of interventions that focus on increasing people's inner resources, like PMR research conducted in India (Dehdari et al., 2009), PMR is an effective therapy used to enhance the psychological well-being and to improve the quality of life of the patients. Additionally, PMR has been demonstrated to considerably reduce patients' perceptions of stress and improve their perceptions of their health. The same study (Sheu et al., 2003) revealed that PMR is helpful for patients who have been diagnosed with essential hypertension.

## II. METHODOLOGY

### *Study design*

This study used a quantitative research framework and a quasi-experimental approach with repeated measurements. The current study was conducted at eight (08) factories spread across different areas and run by one of Sri Lanka's top private sector apparel manufacturers.

### *Sampling Method*

The sampling technique used for the study for selection the participants is Purposive sampling.

### *Sample size*

The G\*power analysis performed using the paired sample t-test's standards revealed that 34 participants were the minimum number of participants needed for the research. A total of 53 for the PMR intervention group and 55 participants for the control group with AjD was selected from a thorough screening process. After two-month PMR intervention, the experimental group remained 49 participants, while the control group ended with 46. This was brought about by participants' withdrawal or their inability to finish the necessary intervention sessions.

### *Sample/ Participants*

The study's sample was made up of individuals from middle level management including managers, executives, and team leaders.

### *Inclusion criteria*

Included were the workers who had undergone screening and been given an Adjustment Disorder diagnosis by the counselors. Additionally, the participants were willing to practice the PMR model-related activity components and complete their homework.

### *Exclusion criteria*

Workers who had additional mental health issues, physical impairments, or were taking medication for other disorders were not included in this study. Employees who were dependent on tobacco, alcohol, or other substances were also not allowed to participate.

### *Materials/ Measures*

The participants had an initial AjD screening in order to collect data. For the first screening, DSM-5 and ADN-20 were used. After the PMR intervention, the ADN-20 Questionnaire was applied as a post-test.

### *DSM-5 diagnostic criteria for Adjustment Disorder*

Across the globe, Psychiatrists and Psychologists use the Diagnostic and Statistical Manual of Mental Disorder -5<sup>th</sup> edition (DSM-5), a manual of diagnostic criteria for various mental disorders (American Psychiatric Association, 2013). The manual states that the symptoms will happen from the first 3 months time of the occurrence of the stressor(s) through emotional or behavioural responses to the particular stressor(s) (American Psychiatric Association, 2013). Additionally, these stress-related symptoms shouldn't meet another standard for mental disorders and shouldn't last for more than six (06) months from the removal of the stressor(s).

According to studies, the DSM-5 has a greater level of internal coherence, with a Cronbach Alpha score of over 0.90. Based on the same study's findings (Patra et al., 2013), when DSM-5 was compared to DSM-IV, DSM-5 was shown to have a greater internal coherence. This manual is recognized as a dependable resource to diagnose mental disorders and is appropriate for the diagnosis of Adjustment Disorder in study participants.

### *Adjustment Disorder-New Module -20 Questionnaire (ADNM-20)*

The Adjustment Disorder-New Module 20 Questionnaire (ADNM-20) is a measure of Adjustment Disorder, consisting of two parts: the stressor list and the item list. In the final part, there is a Likert scale used to gauge how frequently individuals experience symptoms of adjustment disorder in the preceding two weeks. The ADNM-20 has various subcategories, including preoccupation, difficulty to adapt, feelings of depression, avoidance, anxiety, and impulsive behaviours (Lorenz et al., 2016). Core symptoms of AjD are considered under these subscales, and the urgency of symptoms is calculated by the total sum score of the items (Lorenz et al., 2016). The Chinese version of the ADNM-20 indicate higher rate of internal consistency (Cronbach's Alpha = 0.93), a reliability coefficient of 0.84, and test-retest reliability of 0.74 (Tang et al., 2020).

A study from Iran demonstrated that the ADN-20 has higher content validity across measures such as Post Traumatic Stress Disorder (PTSD) symptom check, Depression, Anxiety and Stress Scale-21 (DASS-21), and Perceived Stress Scale (PSS) (Reza Sarafraz, 2018). The validation process involved translation, validation, and adaptation following WHO-recommended guidelines (World Health Organization, 2010). The final version was sent to three mental health experts for expert panel review, and the English version was pre-tested upon attestation from all experts.

#### Data collection procedure

The study involved trained counsellors screening employees at eight leading garment factories with adjustment disorder after receiving ethical approval from the General Sir John Kotelawala Defence University review committee. The ADN-20 screening tool and DSM-5 standards were used, and only employees with an adjustment disorder diagnosis were chosen. Informed consent was obtained, and a sociodemographic questionnaire was given. Participants underwent an eight-week PMR intervention after a pre-test examination. The trained volunteer counsellors administered the intervention on-site, and the same subjects were evaluated again using the same scale to determine the severity of their adjustment disorder symptoms. The control group was invigilated parallelly before and after the applying the measurement scales and these individuals had received no intervention during the eight weeks.

#### Data Analysis

The data analysis tool used for the study was the SPSS version 23. Descriptive statistics were presented using frequencies. Non-parametric tests were used for the study to understand the relationship between them, since the study variables were not normally distributed. Hence, the Mann-Whitney U tests and Wilcoxon signed-rank tests were utilized and a significance level ( $p < 0.05$ ) less than or equal to 0.05 was used to identify the statistical significance.

#### Ethical Considerations

Approval for the study was obtained from the Ethics Review Committee of General Sir John Kotelawala Defence University of Sri Lanka. It was made sure that no biasness occurred during the screening process by the age, socioeconomic status, income, ethnicity, religion, or sexual orientation of the participants. The participation of the individuals were voluntary and the informed consent was ensured. Confidentiality was ensured by storing data on a password-protected computer and keeping all data anonymous. Surveys were given a unique identification code to maintain confidentiality. Participants were not expected to experience physical or psychological harm during the study, and if they did, they were referred to

experts for psychological care. Research counsellors assisted in treating control group members, including dropout participants, by referring them to internal counsellors who had completed the same training course. Referral notices were distributed to the participants' experiencing conditions in sealed envelopes.

### III. RESULTS

In total 91 participants were selected at random, 45 participants for the PMR group ( $n = 45$ ) and 46 participants for the control group ( $n = 46$ ). Among them 54.9% ( $n = 50$ ) participants were female, and 45.1% ( $n = 41$ ) participants were male. A majority of 47.3% of the participants were of 26 to 35 years. A higher proportion of the participants were married (48.4%) More than half of the participants (61.5%) had completed GCE A/ls or a diploma (Table 1).

Table 1. Socio-demographic analysis of the participants

Variables	Males		Females		Total	
	n	%	n	%	n	%
<b>Age group</b>						
18-25 years	9	22.0	20	40.0	29	31.9
26-35 years	21	51.2	22	44.0	43	47.3
36-45 years	6	14.6	5	10.0	11	12.1
46-55 years	5	12.2	3	6.0	8	8.8
<b>Marital status</b>	<b>n</b>	<b>%</b>	<b>n</b>	<b>%</b>	<b>n</b>	<b>%</b>
Single	4	9.8	2	4.0	6	6.6
Divorced	15	36.6	26	52.0	41	45.1
Married	22	53.7	22	44.0	44	48.4
<b>Department</b>	<b>n</b>	<b>%</b>	<b>n</b>	<b>%</b>	<b>n</b>	<b>%</b>
Human Resource	1	2.4	2	4.0	3	3.3
Industrial Engineering	3	7.3	1	2.0	4	4.4
Other	8	19.5	12	24.0	20	22.0
Production	21	51.2	27	54.0	48	52.7
Quality Assurance	5	12.2	8	16.0	13	14.3
Stores	3	7.3	2	4.0	3	3.3
<b>Highest educational qualification</b>	<b>n</b>	<b>%</b>	<b>n</b>	<b>%</b>	<b>n</b>	<b>%</b>
GCE O/L	11	26.8	10	20.0	21	23.1
GCE A/L / Diploma	24	58.5	32	64.0	56	61.5
Degree or higher	6	14.6	8	16.0	14	15.4

Source: Author Analysis, 2023

Results of the ADNM-20, DASS-21, GHQ-12 and K10 scales were analysed. Figure 1 shows a comparison of the mean scores between the PMR- intervention group and the control group before and after the intervention period for all the scales used.

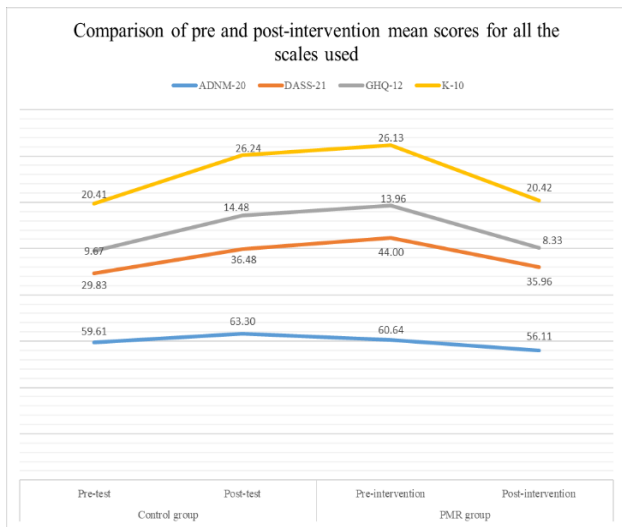


Figure 2. Comparison of the PMR and control groups' mean scores at baseline and following the intervention for all of the used scales. Source: Author Analysis, 2023

Figure 1: Comparison of the PMR and control groups' mean scores at baseline and following the intervention for all of the used scales.

Based on ADNM-20 scores, Wilcoxon-signed rank tests revealed that the control group is statistically significant showing an increase pre and post intervention ( $Z = -3.61$ ,  $p < 0.001$ ), in comparison to the PMR group that indicated a decrease in scores in the post tests ( $Z = -2.15$ ,  $p = 0.03$ ). The DASS-21 scores indicated a reduction in the pre and post tests and is statistically significant for the PMR group ( $Z = -2.11$ ,  $p = 0.03$ ), considered to the control group has an increase post intervention ( $Z = -3.59$ ,  $p < 0.001$ ). Meanwhile, the GHQ-12 scores on the control group is statistically significant while having an increase in the scores since pre to post tests ( $Z = -5.03$ ,  $p < 0.001$ ), whilst the PMR group had a reduction of the scores in the follow-up assessment ( $Z = -3.79$ ,  $p < 0.001$ ). The K10 scores too showed a similar changes in score, whereas a decrease in scores was recorded in the PMR group post intervention ( $Z = -4.108$ ,  $p < 0.001$ ), while an increment was recorded in the controlled group ( $Z = -5.069$ ,  $p < 0.001$ ).

The change in scores from pre-intervention to post-intervention differed significantly between the two groups across all the scales measured. Median scores of the PMR group were of statistical significance compared to those of the controlled group (Table 2). The median ADNM-20 scores in the PMR group (mean rank = 55.70) were statistically significantly higher than the control group

(mean rank = 36.51) ( $p = 0.001$ ). Median DASS-21 score was statistically significantly higher in the PMR group (mean rank = 56.26) than in the control group (mean rank = 35.97),  $p < 0.001$ . The median GHQ-12 scores in the PMR group (mean rank = 63.11) were statistically significantly higher than that of the control group (mean rank = 29.26),  $p < 0.001$ . Finally, the change in K10 scores from pre-intervention to post-intervention was also statistically significant between the PMR and control group, with a mean rank of 63.84 for the PMR group and 28.54 for the control group respectively.

Table 2. Differences in median change in scores from a baseline to post-intervention between the PMR and control group using the Mann-Whitney U-test

SCALE	U	Z	P-VALUE
ADNM-20	1471.5	3.47	0.001
DASS-21	1496.5	3.68	0.000
GHQ-12	1805.0	6.12	0.000
K10	1838.0	6.39	0.000

Source: Author Analysis, 2023

#### IV. DISCUSSION

The present study analysed middle-level management employees in selected apparel sector factories who presented themselves with Adjustment Disorder (AjD) symptoms. They were treated with an eight (08) week PMR intervention program and immediately analysed for AjD symptoms.

This study employed multiple measurement scales to assess the effect of the intervention in the PMR experimental group and the control group. To date, no gold standard exists for the assessment of AjD. Nonetheless, the Adjustment Disorder New Module-20 (ADNM-20) aims to bridge this gap (Lorenz et al., 2016). Therefore, the ADNM-20 scale was selected for the study. The Depression Anxiety Stress Scale (DASS-21) is a well-validated and widely used measure of psychological distress. It provides separate subscales for depression, anxiety, and stress, allowing for a detailed assessment of these constructs, which are symptoms of AjD (Ng et al., 2007). General Health Questionnaire (GHQ-12) and the Kessler Psychological Distress Scale (K10) measure a broad range of psychological distress symptoms such as depression and anxiety. These scales were utilized to complement the results from the first two measurement scales.



To understand the effectiveness of PMR in managing AjD symptoms among selected apparel sector employees in Sri Lanka was the core objective of the paper. A significant reduction in ADN-20, DASS-21, GHQ-12 and K10 scores was seen in the PMR intervention group following the 8-week intervention, as opposed to the control group. The controlled group had showed significant increments in scores across all scales measured after the 8-week period with no therapeutic intervention. The findings of the study reflects with several other studies, such as the research conducted among nurses treating COVID-19 patients by Ganjeali and colleagues (2022), where participants were assessed for stress and anxiety using the DASS-21 scale at baseline and following a 2-week PMR intervention. The findings revealed that significantly reduction was recorded in the scores for stress and anxiety. Similarly a quasi-experimental study carried out in Malaysia in two automotive workshops through a 9-month PMR intervention showed that even by a 10 to 15 minutes of PMR therapy can be effective in decreasing the stress levels perceived at the workplace (Sundram et al, 2016). Merakou and colleagues (2019) had identified that an 8-week PMR intervention together with counselling elicited significant improvements in depression, anxiety and stress symptoms in long-term unemployed citizens in Greece, compared to the control group which received only counselling which also resonates with the current research finding.

This study utilized an 8-week PMR intervention program with 8 therapy sessions, which was found to be effective in alleviating the symptoms of stress, depression, and anxiety among the participants of the study. The study further upgraded on the meta-analysis which suggested that a minimum of 6 PMR therapy sessions were required to observe a favourable health outcome (Van der Klink et al., 2001).

## V. CONCLUSION

Our findings support the advancing body of research suggesting that PMR can be used to significantly alleviate symptoms of AjD and in turn to improve health outcomes, leading to better occupational functioning in the workplace. Future studies should focus on PMR interventions to be implemented other layers of the apparel industry and beyond. Further, the possibilities of using PMR in conjunction with other therapies or counselling services to ascertain the efficacy of the technique as a routine therapy in managing Adjustment Disorder can be explored in future studies.

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# Identifying the improvement of Gross Motor Skills of preschool children in Monaragala District

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**Abstract-** Gross Motor Skills (GMS) are the foundations for more complicated motor abilities and movement patterns, and the underlying performance competency required for many types of physical exercise. This study was to identify the improvement of GMS of preschool children in the Monaragala district. Forty Students (n=40) participated from two preschools (30 in the treatment group and 10 in the Control group). GMS was tested using the Test of Gross Motor Development (TGMD-2). Including six skills per subset and there were two subsets. Loco Motor Skills(LMS) (run, gallop, hop, leap, horizontal jump, and slide) and Object Control Skills (OCS) (striking a stationary ball, stationary dribble, catch, kick, overhead throw, and underhand roll). The gathered data were analyzed using, Pearson correlation, paired-sample T-test, and independent T-sample test in SPSS (V22) software and Microsoft Office 2013. According to the results, the paired t-test and independent t-test were utilized to achieve the main objective. Paired t-test showed that there is a significant difference between the pre-test and post-test in the LMS score ( $P\text{-value } 0.000 < 0.05$ ), OCS score ( $P\text{-value } 0.000 < 0.05$ ) in the treatment group, and LMS score ( $P\text{-value } 0.024 < 0.05$ ) in the Control group. There is no significant difference in the OCS score ( $P\text{-value } 0.274 > 0.05$ ) in the Control group. Finally, an independent t-test revealed that the mean difference of the treatment group is greater than the control group in both LMS ( $11.87 > 0.60$ ) and OCS ( $11.03 > 0.30$ ). It could be concluded that there is an improvement in the GMS of treatment group because of the training.

**Keywords—Gross Motor Skills, Loco Motor Skills, Object Control skills, Preschool Children**

## I. INTRODUCTION

Gross motor skills are the foundations for more complicated motor abilities and movement patterns, and the underlying performance competency required for many types of physical exercise. They are usually split into two categories: locomotor skills (running, hopping, and jumping) and object control skills (catch, throw and kick). Because of the importance of motor skills in children's physical, cognitive, and social development, motor skill development is emphasized in early childhood and primary school physical education curricula. According to the Early Childhood Development Authority

(childsec.gov.lk,2023), Preschool children are divided into three age group categories,

- Between Ages 2 – 3
- Between Ages 3 – 4
- Above Age 4

Among These; Early Childhood is considered to be the most special because the human brain finishes 90% of its development. For this reason, need to be given special care in this stage. (N.T.Edwards,1984)

Comparing the world's Preschools, Sri Lankan preschools are in very poor condition. Because since childhood, there is no suitable procedure to conduct physical activity in our country. It is an essential factor in being active from childhood. Movement activity is vital for children's health, well-being, and development, now and in the future. Activity has lots of health benefits for children. It strengthens children's bones, muscles, hearts, and lungs, improves children's coordination, balance, posture, and flexibility, helps children stay healthy, and reduces their risk of getting heart disease, cancer, and type-2 diabetes later in life.

In Sri Lanka, there is currently no established framework for incorporating fundamental movement education into preschool curricula. However, the implementation of a well-structured action plan could significantly enhance children's overall proficiency. This is the primary motivation behind my dedicated efforts in conducting this research. Notably, this study represents a novel undertaking within the context of Sri Lanka, with potential far-reaching advantages for children and those associated with their development. The study aims to unravel the significance of fundamental movements in the growth and development of preschoolers. Given these considerations, delving into the impact of physical activity on preschool children becomes crucial in order to optimize their capabilities.

### Major objective

A. To identify the improvement of Gross motor skills of preschool children in Monaragala District.

### Specific objectives

B. To identify the gross motor skills level and create a suitable training plan to develop the Gross Motor Skills of preschool children in Monaragala District.

- C. To identify the relationship between gross motor skills and age groups
- D. To identify the difference between the Locomotor skills and Object control skills in Pretest and Posttest
- E.

## II. METHODOLOGY

### A. Hypothesis

According to research, the hypothesis was built up, and both independent variables and dependent variables were considered. The hypothesis of this study was,

Ho; There is no significant difference in the Gross motor skills of preschool children

H1; There is a significant difference in the Gross motor skills of preschool children

H0 = There is no improvement in gross motor skills of preschool children

H1= There is an improvement in gross motor skills of preschool children

### Research Design

The researcher used the quantitative research method. The study was conducted by self-visit to preschool and engaging with Gross motor skills in each preschool child in Monaragala District. Observation and testing were used as the main data collection method

### Study Population and Sample

In the Monaragala District, there are a total of 536 preschools. For this study, a purposive sampling method was employed to select two preschools. From each selected preschool, 20 children were chosen to participate. As a result, the researcher included a total of 40 children from both preschools in the study.

Preschool 1– 20 children (Male = 12, Female = 08)

Preschool 2– 20 Children (Male = 12, Female = 08)

The total sample is 20 + 20 = 40 Students

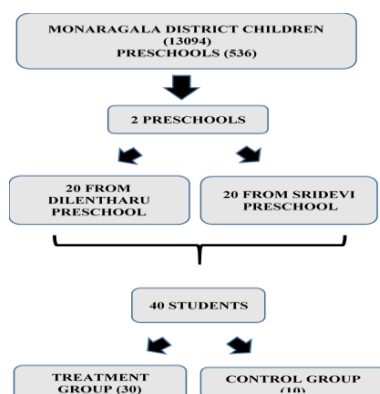


Figure 1: Sample selection method

### Data Collection Methods

Data was gathered for the study by observation and a test

was used as the main data collection method. The test TGMD-2 (Test for Gross Motor Development Second Edition) was employed to collect the data.

### Test of Gross Motor Development (TGMD-2)

Gross motor movement performance was assessed using the Test of Gross Motor Development-2 (TGMD-2; Ulrich, 2000). The TGMD-2 is a qualitative, process-oriented measure (that is, it evaluates movement based on the demonstration of performance criteria that provide information about how the movement was performed) used to assess 12 gross motor skills. The gross motor skills are classified (Fragala-Pinkham, M.A., 2017) as locomotor skills (run, gallop, hop, leap, jump, and slide) and ball skills (run, gallop, hop, leap, jump, and slide) (striking the ball, stationary bounce, catch, kick, overhand throw, and underhand roll).

Purpose: Combines fun activities with a reliable and valid procedure that gives meaningful results in identifying children with gross motor problems: 3-0 years through 10-11 years. Administration Time; The test took 12-15 minutes per child to administer. Preparation has taken 5 minutes longer. There is some distance measuring. To avoid delays and reduce time spent retrieving balls, the examiner should collect a large number of balls to use and move the student quickly through the test items. In most cases, only one session is required to administer the test. However, the test was administered in two sessions due to inclement weather in some areas, particularly Sikkim.

Scoring the TGMD-2: Each gross motor skill includes several behavioral components that are presented as performance criteria. In general, these behaviors represent a mature pattern of the skill. If the child performs a behavioral component correctly, the researcher marks a 1; if the child does not perform a behavioral component correctly the researcher marks a 0.

### Data Analysis and Presentation

Data was acquired through both observation and the TGMD-2 test. Microsoft Office software was utilized to present the gathered data and information. The creation of charts was facilitated using both Microsoft Excel and Word.

Analysis and interpretation of data are planned to do after collecting enough information. The data and information will be presented as tables, percentages, charts, graphs, and images it will be helpful to present the information clearly and in an artistic way.

### III. RESULTS

Table 1. Analyze the demographics of the sample

Demographics	Categories	Frequency (n=40)	Percentage (%)
Gender	Male	29	72.5
	Female	11	27.5
3) Age	4 – 4.5 years	02	5
	4.6 – 4.11 years	11	27.5
	5 – 5.5 years	18	45
	5.6 – 5.11 years	09	22.5

The data on respondents' traits are presented and analyzed. These are the demographic characteristics of respondents that were obtained.

According to Gender, there were 72.5 percent (n = 29) Males and 27.5 percent (n=11) Females among the total number of participants (40) who participated in the study. According to the age categories, 4 – 4.5 years, 4.6 – 4.11 years, 5 – 5.5 years, and 5.6 – 5.11 years were four age categories in this research study. Percentage and number of age category between 4 – 4.5 years (5%, n= 2), the age 4.6 – 4.11 years (27.5%, n=11), age category of 5 – 5.5 years are (45%, n=18), age category 5.6 – 5.11 years are (22.5%, n=9).

#### Correlation Analysis

##### Correlation of Age and Gross Motor Quotient

Pearson measures the relationship between two variables. There is a negative Correlation (Relationship) Between Age and Gross Motor Quotient in this case. Because  $R = (-0.657)$  and  $(P = 0.000)$  which is correlated and is perfectly significant because it is less than 0.05. The negative correlation means that when age is decreased Gross Motor Quotient Will Increase.

Table 2: Locomotor skill score in the treatment group

Treatment Group	Mean	N	Sig;
Pair 1 Pretest Loco Motor Skill Score	28.50	30	0.000
Posttest Loco Motor Skill Score	40.37	30	

Ho; There is no significant difference in the Loco Motors Skill in Treatment Group

H1; There is a significant difference in the Loco Motors Skill in Treatment Group

According to the Treatment Group's Results, there is a significant difference in the mean scores of the Loco Motor skill scores of the Treatment group. The pretest mean score is 28.50 and the post-test mean score is 40.37. It means the performance of children who have provided the training is increased.

Table 3: Locomotor Skill Scores in Control Group

Control Group	Mean	N	Sig:
Pair 1 Pretest Loco Motor Skill Score	26.80	10	0.024
Posttest Loco Motor Skill Score	27.40	10	

Ho; There is no significant difference in the Loco Motors Skill in Control Group

H1; There is a significant difference in the Loco Motors Skill in the Control Group

According to the Control Group's Results, There is a significant difference in the mean scores of the Loco Motor skill scores of the Control group. The pretest mean score is 26.80 and the post-test mean score is 27.40, the performance of children who have not been provided the training also increased.

Table 4: Object Control Skill Scores in Treatment Groups

Treatment Group	Mean	N	Sig:
Pair 1 Pretest Object Control Skill Score	29.40	30	0.000
Posttest Object Control Skill Score	40.43	30	

Ho; There is no significant difference in the Object Control Skill in the Treatment Group

H1; There is a significant difference in the Object Control Skill in the Treatment Group. There is a significant difference in the mean scores of the Object Control skill scores of the Treatment group. In the pretest mean score is 29.40 and the post-test mean score is 40.43 It means the performance of children who have provided the training is increased.

#### Independent sample t-test

Table 5: Difference of Loco Motor Scores of Treatment and Control Group

Training Groups		N	Mean	Sig;
Loco Motor Difference	Treatment Group	30	11.87	0.000
	Control Group	10	.60	



H0: There is no significant difference in the difference of Loco motor skills

H1: There is a significant difference in the difference of Loco motor skills

There is a significant difference of loco motor skills in both treatment and control group. Both the things have been tested this is a significant difference in the group of children who have been provided the training (treatment group) and the group of children who have not been provided the training. There is a significant increase in the performance of both groups. But increase in the performance of the treatment group is greater than the control group.

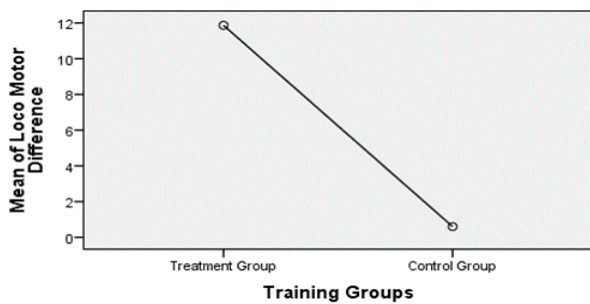


Figure 2: Mean difference of treatment group

Table 6: Difference of Object Control Score of Treatment and Control Group

Training Groups		N	Mean	Sig:
Object Control Difference	Treatment Group	30	11.03	0.000
	Control Group	10	1.03	

H0: There is no significant difference in the difference of Object Control skills

H1: There is a significant difference in the difference of Object Control skills

There is a significant difference of Object control skills in both treatment and control group. Both the things have been tested this is a significant difference in the group of children who have been provided the training (treatment group) and the group of children who have not been provided the training. There is a significant increase in the performance of both groups. But increase in the performance of the treatment group is greater than the control group.

#### IV. DISCUSSION AND FINDINGS

This study identifies the improvement of gross motor skills in preschool children in the Monaragala District. Gross Motor skills are critical to integrating into the lives of children and adolescents. It sets the foundation for facilitating and maintaining healthy active living through adulthood (Cragg & Cameron, 2006; Stolleyetal. 2003), and physical activity levels have been shown to track from

year to year (Pate, Baranowski, Dowda, & Trost, 1996). The training program is conducted to develop Locomotor skills and object control skills. There are 40 preschool children and females 11 (27.5%) and males 29 (72.5%). There is a Treatment group that consists of 30 children and 10 in the Control group. There are four age categories and are age category between 4 – 4.5 years (5%, n= 2), the age 4.6 – 4.11 years (27.5%, n=11), the age category of 5 – 5.5 years (45%, n=18), age category 5.6 – 5.11 years are (22.5%, n=9). According to the correlation analysis, there is a relationship between the age effect on the Gross Motor Quotient of Children and the relationship is negative. When age is increased Gross Motor Quotient will Increase.

According to the Paired sample t-test analysis, there is an improvement in the mean score of locomotor skills of both treatment and group and they are significantly different. As well as there is an improvement in the mean score of object control skills of the treatment group and it is also significant. But if there is an improvement in the mean score of object control skills in the control group it is not significantly different. Because it is improved in less amount.

According to the independent t-test analysis, there is a huge difference in mean scores and there is a significant improvement in the treatment group greater than the control group because of the training program.

#### V. CONCLUSION

Parents are facilitating their children's involvement in physical activities, driven either by their lack of familiarity with physical activities or their desire for their child to participate in the study program. All sectors possess a comprehensive comprehension of movement patterns and the development of gross motor skills. The government has initiated several initiatives with the objective of motivating school children to partake in physical activities. Physical development, also known as gross motor development, is not solely the duty of the government and schools; it also falls on the shoulders of parents and individuals. Gross motor development is always aided by excellent muscle and muscle tone; however, when this is lacking, gross motor development is slowed. The physical activity knowledge program is critical in establishing scholastic prospects for gross motor development and its implications in sports and other forms of gross movement alertness. Physical activity is defined as gross motor movement, which is an important indicator of a person's lifespan. When we are physically active, our daily activities continue. In conclusion, the analysis was made based on the statement and objective of the study. The following finding was there is a negative correlation between age and gross motor quotient, A significant difference was found between the pretest and post-test in



the locomotor skills in the treatment group, and A test in the loco motor skills in the control group, A significant difference was found between pretest and post-test in the object control skills in the treatment group, no significant difference was found between pretest and post-test in the object control skills in the control group and finally, there is a significant improvement in treatment group greater than control group because of the training program.

significant difference was found between pretest and post-

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# IoT Security Assessment and Mitigation Strategies for Resilient Military Operations

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**Abstract**— This study examines how military operations are relying more and more on Internet of Things (IoT) technology, which has both advantages and security risks. In order to understand the influence of operational resilience on IoT security risks and vulnerabilities peculiar to military operations, the study identifies and evaluates these issues. Additionally, it tries to spot weaknesses in current assessment practices and frameworks and provide enhanced frameworks specifically designed for resilient military operations. Additionally, while taking into account the necessity for both proactive security measures and reactive incident response skills, the research looks into efficient mitigation techniques to solve IoT security problems in military operations. To gather and analyze qualitative and quantitative data from research papers, data reports, and articles, the study employs a thorough methodology. The findings and discussions will shed light on the IoT security concerns that have been found, the shortcomings of the current evaluation processes, and suggested mitigation tactics. To secure the integrity and effectiveness of military activities, the research emphasizes the significance of improving IoT security in military operations.

**Keywords**— **IoT security, Military operations, Operational resilience, Mitigation strategies**

## I. INTRODUCTION

The military industry has seen significant change as a result of the Internet of Things (IoT) technology's rapid progress in recent years. Modern military operations now have access to unmatched benefits related to the IoT's seamless integration of interconnected devices, sensors, and systems. The context-setting information in this opening section sets the stage, which also emphasizes the importance of IoT technology in military situations. Additionally, it describes the military's growing reliance on IoT and explains the study's goals and focus.

The way armed forces carry out their objectives and uphold national security has been changed by the integration of IoT technology in military operations. Unmanned aerial vehicles (UAVs), wearable technology, security cameras, and logistics management systems are just a few examples of the massive network of smart

devices that can be created simply due to the Internet of Things (IoT), which promotes real-time data interchange and decision-making capacities. IoT has been widely adopted because of its potential to improve military productivity, adaptability, and situational awareness.

Adoption of IoT in military operations improves communication, maintenance prediction, logistical optimization, situational awareness, and training and simulation. IoT devices offer real-time decision-making, effective mission planning, and quick reactions to dynamic battlefield conditions by producing enormous amounts of data. Predictive maintenance improves the preparedness of military assets and decreases downtime. Supply chain operations are optimized by IoT-driven data analytics, and training and simulation are supported by augmented and virtual reality.

IoT brings new, challenging security issues as it permeates more military operations.

**Cyberthreats:** When IoT devices are interconnected, the attack surface is larger and military networks are more vulnerable to cyberthreats such data breaches, malware infiltration, and denial-of-service assaults. These dangers have the potential to jeopardize vital military data and disrupt operations.

**Data Privacy and Integrity:** considering that military data is sensitive, strong measures must be taken to protect its privacy and integrity. Data manipulation or unauthorized access can have serious repercussions for national security, putting military operations and strategic planning in danger.

IoT devices are frequently purchased from different vendors, which leads to supply chain risks. The overall security of military systems could be jeopardized by compromised components or malicious firmware.

**Lack of Standardization:** It is difficult to develop a coherent and reliable security framework since different IoT devices lack established security protocols.

*Insider Threats:* A key aspect of IoT security continues to be human interaction. Insider threats have the ability to compromise military systems by exploiting flaws, whether on purpose or accidentally.

To preserve the integrity and efficacy of military operations, it is crucial to strike a balance between utilizing the potential of IoT technology and reducing its related dangers in light of these advantages and security challenges.

The growing use of Internet of Things (IoT) technology in military operations add a number of security concerns and weaknesses, though, which could have a big impact on the efficiency and reliability of military operations.

The following are some of the main IoT security concerns and weaknesses particular to military operations:

IoT devices connected to military networks are a possible target for cyber adversaries, resulting in cyberattacks and data breaches. Successful cyberattacks on IoT devices have the potential to compromise the security, integrity, and availability of sensitive data by allowing unauthorized individuals access to vital military data.

In military operations, physical tampering and device authentication are essential since IoT devices may not have strong security measures, making them vulnerable to unauthorized access. IoT devices are vulnerable to eavesdropping and man-in-the-middle attacks because they are deployed in hostile locations and via insecure communication channels. Sensitive data can be compromised as a result of inadequate device authentication and physical manipulation. Strong device authentication and secure communication channels in IoT devices are crucial for reducing these hazards. IoT supply chains and insider threats provide security hazards because they can take advantage of flaws in manufacturing and manufacturing systems. These flaws could allow for the introduction of forged or stolen components into IoT systems for the military. As older systems might not have been developed with IoT security in mind, legacy system integration might also provide compatibility and security difficulties. Additionally, insider attacks might compromise sensitive data or jeopardize operations, making military personnel with access to IoT devices and networks a security risk. IoT device vulnerabilities in the firmware and software can also be used by attackers to take over the target device.

In order to comprehend operational resilience in military IoT environments, one must first understand resilience in the context of military operations and how it relates to the use of IoT technology. Operational resilience is the

capacity of military systems and troops to foresee, withstand, adapt to, and recover from shocks, disruptions, or adversary operations while retaining core capabilities and capabilities. Operational resilience in the context of military IoT environments focuses on the ability of military operations to resist and effectively respond to IoT-related obstacles and threats. Threat Awareness, Resilience Planning, Redundancy and Diversity, Real-Time Monitoring, Adaptive Capacity, Incident Response and Recovery, Training and Education, and Integration with Military Doctrine are key concepts in understanding operational resilience in military IoT contexts.

#### *A. Research objectives and Research Questions*

In order to understand how these risks affect the resiliency and efficacy of military operations, it is important to recognize and analyze the key IoT security risks and vulnerabilities that are specific to military operations. To analyze the shortcomings and shortcomings of the IoT security state of military systems using the current evaluation methodologies and structures, and to provide modified or enhanced frameworks tailored to the unique challenges faced by resilient military operations. And also, To investigate and make recommendations for efficient mitigation strategies and countermeasures for dealing with IoT security issues in military operations, taking into account the necessity for both proactive precautions and reactive incident response capabilities.

#### *B. Research Questions*

1. What are the main IoT security risks and vulnerabilities that are unique to military operations, and how do they affect the resilience and effectiveness of these operations?
2. What are the major flaws and drawbacks in existing assessment methods and structures for evaluating the IoT security state of military systems, and how can these structures be adapted or improved to effectively address the specific difficulties faced in resilient military operations?
3. What are the best mitigation tactics and countermeasures for IoT security flaws in military operations, taking into consideration the necessity for both preventive measures and reactive incident response capabilities?

## II. METHODOLOGY

The introduction, goals, and objectives of the research were stated at the beginning of the first chapter. A qualitative methodological approach was suggested based on the study's correlational nature, data accessibility, and contextual significance through the use of primary and secondary sources. The method will be applied to the data analysis in the subsequent chapter, which will be followed

by a discussion of the findings, outcomes, and recommendations.

### III. DISCUSSION

The military Internet of things is widely employed in a variety of areas, including smart camps, sites, campuses, transportation, intelligent medical care, and other areas. There are numerous issues that arise when using military Internet of Things technology to meet the demands of various military applications. For instance, there are numerous types of terminal equipment that come in a variety of shapes, sizes, and functions, and different network connecting technologies, such as wired, wireless, Bluetooth, Zigbee, third generation mobile communication, fourth generation mobile communication, fifth generation mobile communication, and satcom. (Li et al., 2020)

- *Mitigation tactics and countermeasures for IoT security flaws in military operations.*

#### 1. *Secure Device Management:*

Implement robust authentication measures to restrict access to IoT devices:

Only authorized users or devices can access the IoT network and its resources thanks to strong authentication. Use MFA (multi-factor authentication) to provide an additional security layer. MFA often combines the user's knowledge (such as a password), possessions (such as a smart card or token), and/or identity (such as biometric information). For IoT devices, avoid using default or weak credentials and impose strict password complexity requirements.

To guarantee that only authorized devices can connect to the network, use device certificates or secure tokens:

Device certificates are cryptographic identifying credentials that allow for secure device identification. Due to their difficulty in forging or breach, they are more secure than conventional passwords. Hardware tokens or smart cards are examples of secure tokens, which add an extra layer of security and can be used in conjunction with other authentication techniques. A valid certificate or token must be presented by a device when it tries to join the network in order to establish its identity and acquire access.

Implement stringent regulations for the registration and deregistration of devices:

For the purpose of registering and administering IoT devices, keep a central repository or database. This enables improved oversight and management. Establish a systematic procedure for network registration and acceptance of new devices. As a result, each device will go through the appropriate security checks before being given access. Create a procedure for de-registering devices that

are no longer in use or that have been compromised. Security is maintained by removing illegal or compromised devices from the network. (Bharti et al., 2022)

#### 2. *Security updates on a regular basis and patch management:*

Update IoT device software and firmware frequently to fix known vulnerabilities:

IoT device makers frequently offer firmware and software upgrades that contain security patches to fix flaws found in the devices. Military organizations should keep up with these changes and make sure their equipment is running the most recent, secure firmware and software. Establish a routine or procedure for monitoring for updates from device manufacturers and swiftly installing them on the currently used devices.

Build a streamlined procedure for timely patch and update deployment:

Create a clear patch management procedure that guarantees the prompt distribution of security updates across all IoT devices connected to the military network. To reduce the risk of exploitation, give priority to crucial fixes that address high-severity vulnerabilities. To save time and effort while patching, think about employing centralized management solutions to remotely apply updates to several devices at once.

It's vital to remember that multiple levels of operational relevance and criticality can apply to IoT devices in military operations. Patch management should therefore take into account the effects of any potential disruptions brought on by updating certain equipment. To keep the mission running smoothly while making sure that devices are properly updated, it could occasionally be necessary to temporarily isolate users or take other security precautions. Additionally, it is crucial to have a clear testing procedure in place before deploying fixes. Some upgrades could cause unanticipated compatibility problems or conflicts with other programs or gadgets. In order to detect any potential negative impacts before deploying patches in a production setting, it is necessary to test patches in a controlled environment.

#### 3. *Intrusion Detection and Prevention Systems (IDPS):*

Use IDPS to quickly identify and stop harmful activity: Network traffic and system activities are watched for indications of suspicious or malicious activity by intrusion detection systems (IDS). Beyond simple monitoring, intrusion prevention systems (IPS) can actively stop or stop detected threats from infecting the network or devices. Strategically place IDPS sensors throughout the military IoT network to assure complete coverage of vital resources and communication pathways. In order to spot patterns suggestive of cyberthreats like malware, unauthorized access attempts, or suspicious data exfiltration, these

systems scan network packets, logs, and other data.(Tan et al., 2023)

Configure IDPS to warn security staff or automatically react to threats:

IDPS systems can alert security staff or automatically respond to threats, thwarting immediate attacks and minimizing harm from possible invasions. However, as they could obstruct legitimate communication, automatic responses might not be preferred in crucial military operations. Integrating IDPS systems with SIEM, maintaining continuous monitoring and routine updates, and undergoing tweaking and fine-tuning are all necessary to enable effective threat detection. It's also essential for qualified security personnel to actively chase down risks in order to find sophisticated dangers that might elude automated systems. Military organizations can significantly improve their capacity to identify and respond to potential cyber threats by deploying IDPS with real-time threat detection capabilities and configuring suitable automated responses, safeguarding the availability and integrity of IoT-enabled military operations.

- *Importance of Operational Resilience in Mitigating IoT Security Risks.*

Given that security incidents can have serious repercussions, operational resilience is of utmost importance in reducing IoT security risks in military operations. It guarantees mission continuity, adaptability to changing threats, prompt incident response, reduction of vulnerability window, situational awareness, contingency planning, protection of sensitive data and communication, preservation of public trust, minimization of impact on personnel, and alignment with legal requirements and standards. Military organizations can dramatically improve their capacity to preserve sensitive information, maintain efficient operations, and defend against cyber threats by giving operational resilience first priority.

- *RESULT*

Financial investments in IoT security measures and mitigation tactics can be resource-intensive, having detrimental effects such resource-intensiveness, complexity, operational delays, false positives/negatives, and difficulties with regulatory compliance. It's vital to strike a balance between security measures and operational continuity since overly aggressive security measures may result in false positives or false negatives, which could impede military operations.

IoT security evaluations and mitigation techniques have a variety of beneficial effects on mission assurance, cyber defense, and decreased downtime. By shielding secret material against illegal access and potential espionage, these precautions guarantee the continuation and success of crucial military activities. Cyber defenses are strengthened by strong security measures, which makes it more difficult

for adversaries to compromise military systems and launch cyberattacks. Effective security assessments and incident response processes reduce operating pauses while promoting cooperation and confidence among allies, partners, and the general public. Long-term cost reductions are achieved through proactive security evaluations that stop expensive data breaches and cyber catastrophes. Strong security measures and resilient IoT systems offer precise situational awareness, safeguard against internal threats, enable flexibility to new threats, and improve the military's reputation and public image. Instilling discipline in the handling of sensitive data, implementing security assessments assures compliance with security standards and legal requirements.

## V. RECOMMENDATION

Military organizations should commit enough resources and manpower for security assessments and mitigation efforts in order to reap the benefits of IoT security assessment and mitigation tactics for resilient military operations. To provide thorough security measures and strike a balance between false positives and false negatives, regular security testing and review are essential. Standardization and interoperability encourage each other and lessen complexity. The significance of following security best practices and being vigilant against potential insider threats is reinforced by ongoing training and awareness campaigns. Information sharing between military organizations, business partners, and governmental organizations is encouraged by giving priority to mission-critical assets and adopting a collaborative approach.

Consistent compliance with pertinent rules and standards is ensured by proactive compliance management. In the event of a security problem, real-time incident response drills help to validate response strategies and save downtime. The need of operational resilience and quick recovery is emphasized in security measures to ensure the continuation of military operations. By incorporating security-by-design concepts into the design and acquisition of IoT devices, security is built in from the start. Engaging security professionals and ethical hackers for unbiased evaluations and validation of security solutions increases operational resilience and safeguards sensitive military assets in an environment where security is becoming more complex and interrelated.(Khan et al., 2021)

## VI. CONCLUSION

The use of Internet of Things (IoT) technology in military operations has created new opportunities for improved situational awareness, communication, and operational effectiveness. But in addition to its benefits, IoT adoption in the military setting also poses serious security concerns and vulnerabilities that could jeopardize sensitive data and

impair crucial operations. In order to address these issues and offer insightful solutions for protecting military IoT deployments, this research has examined IoT security evaluation and mitigation techniques in robust military operations.

In order to address IoT security risks and vulnerabilities, the study underlines the significance of operational resilience and resilience in military operations. It emphasizes the constantly changing nature of cyber dangers and the necessity of constant observation and flexibility in security evaluations. The study criticizes the shortcomings of the current evaluation techniques and suggests improvements such as dynamic risk modeling, integration of threat intelligence, incident simulation, and red teaming exercises. Effective protection of military IoT networks depends on the use of preventative mitigation tactics and countermeasures. The paper makes major contributions to IoT security and military operations, providing military stakeholders with doable security solutions.

The study emphasizes the important role that IoT security evaluation and mitigation play in robust military operations. It adds significant knowledge to the subject of IoT security by highlighting operational resilience, detecting dangers, and suggesting improvements. In order to guarantee the integrity and efficacy of military operations and, ultimately, to protect national security and interests, a proactive and adaptive security approach is essential.

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# Negative Effects of Integrating Chat GPT in the Higher Education System Concerning Achieving Resilience through Digitalization, Sustainability, and Sectoral Transformation

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**Abstract** – *The integration of Chat GPT (Generative Pre-trained Transformer) in higher education has gained significant attention due to its potential for advancing digitization, sustainability, and sectoral transformation. However, it is essential to consider the potential drawbacks associated with this integration to ensure educational resilience. This research aims to identify and evaluate the negative effects of integrating Chat GPT in the higher education system, focusing on academic quality, customization, ethical concerns, and technology dependency.*

*The study adopts a mixed-method approach, utilizing qualitative methods such as interviews and focus groups with educators, students, and stakeholders, as well as quantitative data gathered through surveys administered to a sample of higher education institutions. Preliminary research suggests that over-reliance on AI-generated information may hinder the development of critical thinking and problem-solving skills among students. Concerns also arise regarding the quality and accuracy of AI-generated content, which can compromise the acquisition of reliable knowledge. The lack of personalized and human interaction during learning may impede student engagement and social participation. Ethical issues related to biases within Chat GPT models have been raised, as they can perpetuate biased behaviors and hinder inclusion efforts. Furthermore, the integration of Chat GPT requires robust technological infrastructure, posing challenges.*

*for resource-constrained institutions and exacerbating existing digital disparities. The findings of this research can inform decision-making in higher education, enabling policymakers, educators, and stakeholders to develop strategies and guidelines that mitigate potential drawbacks while maximizing the benefits of integrating Chat GPT in the pursuit of resilience, digitalization, sustainability, and sectoral transformation.*

**Keywords** - Chat GPT (Generative Pre-trained Transformer), Higher education system, Negative effects

## I. INTRODUCTION

The future of higher education is being relentlessly pushed toward a digitally transformed and sustainable future, and it is at a critical turning point. The incorporation of cutting-edge technology, like Chat GPT, has promised to transformable improvements in administrative, teaching, and learning processes. But as the world strives for resilience through digitalization, sustainability, and sectorial transformation, it is becoming more and more important to critically assess the possibly negative effects of this technology embrace inside the revered halls of academia.

A key component of the worldwide effort to build resilience is higher education, which is frequently viewed as the breeding ground for innovation and the development of future leaders. However, as institutions hastily implement conversational agents powered by artificial intelligence, the implications for academic resilience require critical examination. Despite the fact that Chat GPT and other AI technologies present benefits for efficiency, personalization, and accessibility, their unregulated incorporation may unintentionally weaken the core principles of resilience in higher education.

Sustainability, another important goal, is inextricably tied to the technological decisions we make. If digitalization is not done carefully, it could add to the growing environmental problems, from higher energy use to more electronic trash. The higher education sector must adopt digital tools and platforms quickly in order to serve pedagogical and administrative needs. It must consider how these choices may affect sustainability.

Additionally, there is a condition attached to the promise of technological sectoral development. While Chat GPT and other AI-powered systems can improve learning outcomes and expedite processes, they also present significant hurdles. These include worries about potential job losses among university employees, concerns about data privacy, and

worries about the depletion of critical thinking abilities when students rely too heavily on AI.

This discussion aims to untangle the complex relationship between incorporating Chat GPT into higher education and the broader goals of creating resilience, sustainability, and sectoral transformation. It seeks to shine light on the shadowy corners of technology adoption, where unforeseen repercussions may lurk. In doing so, we hope to promote a more nuanced awareness of the risks associated with innovation, as well as to assist higher education institutions toward a more balanced and careful acceptance of AI technologies within the context of resilience, sustainability, and sectoral transformation.

### *I. Research Objectives and Research Questions*

**Evaluating the Effect on Pedagogical Resilience:** To examine how the incorporation of Chat GPT and other AI technologies influences the adaptability and resilience of pedagogical techniques in higher education, taking into account aspects such as student engagement, critical thinking, and the ability to respond to unexpected difficulties.

**Evaluating the Environmental Footprint:** Quantifying the environmental effects of AI integration in higher education by analyzing energy usage, carbon emissions, and electronic trash generated, and proposing sustainable ways for mitigating these impacts.

**Examining Workforce Implications:** To investigate the possible labor market disruptions caused by AI integration, such as the displacement of traditional administrative and teaching positions, and to offer ways for reducing negative employment implications in the higher education sector.

**Investigating Privacy and Ethical Issues:** With an emphasis on data security, student information protection, and the responsible use of AI-driven tools, this research will identify and assess the privacy and ethical issues that arise from the use of AI chat bots in higher education.

**Assessing Learning Outcomes:** In order to determine whether AI chat bots can help or hinder sectoral transformation, it is important to assess how they affect student learning outcomes, such as academic performance, information retention, and the development of critical thinking abilities.

**Creating Actionable Policy Recommendations:** To integrate AI technologies into higher education institutions in an efficient manner while coordinating with the objectives of resilience through digitalization, sustainability, and sectoral transformation.

**Engaging Stakeholders:** Incorporating the opinions of educators, students, administrators, and industry experts into

the research process to ensure a thorough knowledge of the diverse implications of AI integration in higher education.

**Comparative study:** Conduct a comparative study of various methods to AI integration in higher education, relying on worldwide experiences, to identify best practices and lessons learned that may influence policy and decision-making.

**Long-Term Impact Assessment:** To predict the long-term consequences of AI integration in higher education, as well as its role in accomplishing societal goals such as resilience, sustainability, and sectoral change, while taking technology breakthroughs and developing educational paradigms into account.

**Findings Dissemination:** To inform important stakeholders, policymakers, and the general public, study findings will be disseminated through scholarly papers, policy briefings, and educational forums. Educating the general public on the potential negative consequences of AI integration in higher education, with the purpose of supporting educated decision-making on this critical topic.

### *II. Research questions*

1. How does the incorporation of Chat GPT and related AI technologies affect higher education institutions' resilience in the face of unforeseen disruptions and challenges caused by digitization and external factors?
2. What are the environmental effects of the extensive usage of AI chatbots in higher education, such as energy consumption, carbon emissions, and electronic trash generation, and how can sustainability be assured while pursuing digitalization goals?
3. How does the integration of AI chatbots affect the learning outcomes of students, and how can these effects be mitigated or leveraged to enhance educational quality?
4. What are the possible labor market implications of AI chatbot adoption in the higher education sector, and how may policies be devised to manage worker displacement and job role alterations throughout sectoral transformation?
5. What are the ethical and privacy concerns with the usage of AI chatbots in higher education, and how may they be properly addressed in order to achieve responsible AI adoption that is consistent with resilience and sustainability objectives?
6. How does the deployment of AI chatbots affect student learning outcomes such as academic performance, critical thinking abilities, and information retention, and how do these effects help or hamper the broader goals of sectoral transformation in higher education?

## II. METHODOLOGY

A mixed-method approach was used, which included quantitative surveys, qualitative interviews, and document analysis. Surveys will be used to collect information about student and faculty perceptions, while interviews will provide in-depth insights. Document analysis will be used to evaluate institutional policies. For quantitative data, statistical tools will be used, and for qualitative data, theme analysis will be used. Ethical issues will take precedence, ensuring informed consent and data security. The findings will be presented, debated, and turned into concrete suggestions for higher education institutions.

## III. DISCUSSION

While the incorporation of Chat GPT and similar AI technologies in higher education holds the promise of improved efficiency and enhanced learning experiences, it also has a number of negative consequences that can stymie the sector's pursuit of resilience through digitalization, sustainability, and sectoral transformation.

**Pedagogical Resilience:** The possible deterioration of pedagogical resilience is one of the key concerns. While AI chatbots can give immediate answers and help, they may unwittingly hinder pupils' critical thinking abilities and self-reliance. Over-reliance on AI for problem-solving may impair students' capacity to adjust to unanticipated problems, which is essential for educational resilience. Educators must find a balance between using AI technologies and encouraging individual problem-solving skills.

Another important problem is the environmental impact of incorporating AI chatbots into higher education. These technologies' increasing energy usage, computational power needs, and electronic waste might jeopardize sustainability goals. To minimize these negative environmental implications, institutions must adopt green AI initiatives such as improving algorithms to reduce energy usage and recycling e-waste responsibly.

**Workforce Disruption:** The incorporation of AI chatbots raises worries about the ramifications for the workforce. Administrative and instructional assistants may lose their jobs if chatbots take over basic duties. This interruption may have an impact on job security and the livelihoods of individuals working in higher education. To solve this, strategies to upskill and reskill impacted workers, as well as establish new positions that complement AI systems, are required.

Ethical and privacy concerns arise as a result of the collecting and use of student data in AI-driven systems. It is vital to protect sensitive information and ensure openness in data utilization. Failure to address these concerns may result in mistrust among stakeholders, undermining the sector's

attempts to develop resilience and trust through digitalization.

**Learning Outcomes:** AI chatbots have a wide range of effects on student learning outcomes. While they can improve accessible and individualized learning experiences, they should not completely replace human interaction. Over-reliance on AI may stifle the development of critical thinking and problem-solving abilities, both of which are required for sectoral transformation. As a result, a precise balance of AI help and human instruction is required to provide complete educational outcomes.

Finally, the incorporation of Chat GPT in higher education has the potential to both advance and obstruct the sector's aims of resilience through digitalization, sustainability, and sectoral transformation. Institutions must be proactive in order to reap the benefits while reducing the negative repercussions. This encompasses initiatives for ethical AI governance, ecologically responsible technology adoption, and workforce adaptation. To achieve resilience in higher education, a careful balance must be struck between embracing innovation and conserving the underlying principles and skills that drive education's progress in the digital era.

## IV. RESULT

The incorporation of Chat GPT into the higher education system poses several obstacles to achieving resilience through digitization, sustainability, and sectoral transformation. While it has advantages in terms of efficiency and accessibility, the loss of critical thinking skills, increased environmental impact, potential workforce displacement, ethical and privacy concerns, and mixed effects on learning outcomes highlight the need for careful thought and proactive strategies. To fully attain resilience, higher education institutions must negotiate the incorporation of AI technologies while remaining committed to the essential ideals of education while effectively addressing the negative implications.

## V. RECOMMENDATIONS

It is critical that schools prioritize ethical principles and transparent data methods when managing the inclusion of Chat GPT and related AI technologies into higher education. The emphasis should be on developing students' critical thinking skills and creativity while establishing a balance between AI aid and human instruction. Adopting sustainable AI techniques, such as optimizing energy consumption and sustainably handling electronic trash, is also critical. Proactive strategies for upskilling and reskilling employees must be introduced to meet workforce challenges. Finally, ongoing review and adaptation of AI initiatives is critical to ensuring that higher education achieves resilience through digitalization, sustainability, and sectoral transformation while reducing negative repercussions.

## VI. CONCLUSIONS

While Chat GPT and comparable AI technologies have enormous potential for innovation and efficiency, they also have drawbacks for efforts to build resilience through digitization, sustainability, and sectoral transformation. This study has brought to light a number of crucial issues that need for thoughtful deliberation and proactive measures. From the standpoint of education, there is a danger of relying too much on AI chatbots, which could jeopardize students' ability to acquire critical thinking and problem-solving skills. For long-term educational resilience, it is crucial to strike a balance between AI help and the development of these fundamental skills. The negative effects of integrating AI on the environment, such as increased energy use and electronic waste, highlight the need for organizations to implement green AI strategies to align technology adoption with sustainability aims. Concerns about labor displacement should not be overlooked, necessitating the deployment of substantial workforce development efforts to upskill and reskill employees affected by AI-driven automation.

Addressing ethical and privacy concerns, developing ethical AI frameworks, and assuring responsible data practices are critical for fostering trust and resilience in a digitally altered educational world. In conclusion, the negative consequences of using Chat GPT in higher education are obvious, but they do not have to be insurmountable. Higher education institutions may negotiate these issues while utilizing the revolutionary potential of AI to achieve resilience, sustainability, and sectoral change in the digital age by taking a strategic and ethical approach. The road ahead will need attention, adaptation, and an unshakable commitment to education's essential ideals.

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## ABBREVIATIONS

- AI – Artificial Intelligence  
GPT – Generative Pre-trained Transformer

# Analysis of Technology Utilization in Sri Lankan State Universities' English Teaching and Learning Process

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**Abstract**— This research paper intends to identify the technological devices utilized for English language acquisition processes in Sri Lankan state universities. The majority of non-linguistic undergraduates face the challenge of conducting their degree programs in English. Hence, both the English language lecturers and the undergraduates utilize different and innovative techniques and technological devices to upscale their English language proficiency. Being in the technological era, both the lecturers and the undergraduates use different digital approaches to make their language education successful. Hence, this research carries the results of eight lecturers and 16 undergraduates from eight geographically spread state universities selected under purposive sampling. The utilized data collection method was semi structured interviews and classroom observations in both virtual and physical contexts. The key findings revealed that the lecturers try to integrate digital games, online activities, interactive boards but do not have as much success with the higher number of undergraduates. Meanwhile, the discussions with lecturers revealed that digital literacy too creates a huge barrier to maximizing student participation. On the other hand, a considerable number of students are using artificial intelligence to get their activities done, and most of them heavily rely on online translators to produce the necessary English output they require as they expressed. Very few students out of the sample mentioned using the free subscriptions of BBC English Learning, Dulingo, and Englishpod101 to improve their proficiency, but not frequently. In a holistic view, undergraduates at state universities have found more instant remedies to get the tasks done than long-term, dedicated practices. While the lecturers' effort to familiarize podcasts, interactive boards, and real-time virtual games too find difficult but are not genuinely supported by the undergraduates in the teaching process.

**Keywords**— digital mechanisms, state universities, English, teaching and learning process

## I. INTRODUCTION

According to Crystal (1997), the role of English has become more prominent than ever as a lingua franca. In the Sri Lankan context, English has become an inevitable proficiency for every individual. Not only for educational purposes but also in career specifications, English has

become a lucrative standard for upward social mobility. (Thirunavukkarsu,2012) Due to the fact that many universities conduct lectures in English as the medium of instruction, students tend to increase their proficiency in English. With the understanding that the majority of undergraduates lack necessary skills in English, there are modules based on proficiency development throughout all academic years.

The use of digital mechanisms to teach and learn English in state universities in Sri Lanka has been a growing trend in recent years. However, the success of these initiatives has been mixed, due in part to the low literacy in technology among students and faculty. (Dearden, 2015) During the post-Covid period, attempts to continue uninterrupted educational sessions augmented the usage of digital strategies. Thereafter, as a method of engagement and a way to deviate from traditional teaching and learning methods, lecturers utilize digital mechanisms. (Embogama,2020) Thereafter, in the attempts to incorporate digital mechanisms in the teaching process, there is a wide range of methods and platforms for utilizing software as a result of limited technical literacy. Even though most of the lucrative education systems use mechanisms to process natural and native language learning environments (Coleman, 2006), it is not possible to learn with limited technological supplies within the classrooms at state universities.

## II. RESEARCH OBJECTIVES

The research objectives are:

- A. To figure out what kind of digital mechanisms are used by the lecturers to teach English.
- B. To trace the methods used by undergraduates to facilitate their English learning.
- C. To understand the reasons and effects of the teaching and learning processes.

## III. METHODOLOGY

The study is conducted at the University of Kelaniya, the University of Sri Jayawardenapura, the University of Ruhuna, Sabaragamuwa University, Rajarata University, the University of Colombo, the University of Jaffna, and the University of Peradeniya. The sample was selected based on purposive sampling as per the lecturers that

conduct general English modules for non-linguistic departments and 16 undergraduates from non-linguistic backgrounds. Data collection was done through individual, semi-structured interviews, which gave them free speech spaces. In order to create a gender-neutral environment among undergraduates, the selection was done with one male and one female participant from each university. The results were analyzed using a qualitative method.

### III. DISCUSSION

During the post-COVID period, the frequency of using digital mechanisms and virtual interactions to teach any stream of studies has gone comparatively higher than before the COVID pandemic. The students had to get used to virtual platforms like Zoom, Google Meet, and Microsoft Teams, which facilitate interaction and promote active engagement and collaboration. The use of digital techniques in teaching English in virtual environments has become increasingly prevalent in state universities in Sri Lanka. Virtual classrooms offer an effective means of real-time interaction between students and lecturers, regardless of their physical location. Yet, most of the undergraduates disregard the ease of joining the classes irrespective of their location due to the low quality and interruptions caused by the internet service providers. This factor leads students to get fed up with continuous attempts to fix their connections while concentrating on the lessons.

As the digital mechanics within the classroom increased, most of the lecturers were incorporating online discussion forums. As a common technique, they post a question on one of the platforms like Miro, Figma, Google Jamboard, Flipgrid, Padlet, or Scribbler (which just one lecturer was utilizing) and ask students to add their points of view or answers to the questions. These forums are utilized in order to allow students to seek assistance, pose questions, and share their perspectives on course content, promoting a deeper understanding of the subject matter. Even though the forums are to be used as a student-centered learning method, very few participate in the given discussions. As mentioned by the lecturers, based on various excuses, they tend to neglect the activity, and from the students' end, many find they are alien to the specific platform, which becomes a concern of digital literacy. Furthermore, the use of educational games can prove beneficial in teaching English virtually. Games provide an interactive and enjoyable learning experience, effectively capturing students' attention and facilitating the acquisition of new language skills. Games seem to attract more attention and participation, but they consume time by giving instructions and waiting for everyone to join and get settled on the platform.

In addition to that, many lecturers have the tendency to attach self-paced, free courses to the subject so the students

may follow them at their convenience. This methodology is identified as a method to leverage teaching English in a virtual environment and a fair attempt to replace traditional lectures, thereby accommodating diverse learning styles and preferences. Additionally, podcasts offer a convenient method for delivering lectures or other course-related content that specifically enhances English listening skills. Students can listen to these audio recordings at their convenience, promoting independent learning and reinforcing lesson concepts. A considerable fraction of undergraduates admires and appreciate the guidance provided by lecturers to find courses at better institutions. Still, transgression occurs as students point out that they do not have much time to contribute to additional courses of English based on their majors.

Moreover, videos serve as a powerful medium to enhance the virtual learning experience. Most of the lectures utilize YouTube and content from content platforms such as Quora and Reddit to provide the class with ideas for their written production. Even though content management is an inevitable component of students' learning processes, their newness to fact-finding has made lecturers start at the preliminary level. Even though lecturers try to create a dynamic and engaging environment that enhances students' understanding and retention of the course material, the results of end-of-semester examinations act as a source of failure for all the innovative attempts, creating a huge contrast with assignments.

In recent years, the availability of digital devices among youth has significantly enhanced the English proficiency learning experience for undergraduates. (Jayathilake et al., 2021) As a fact, the modulated or systemized language being English, many students generate awareness among the associated jargon for the specific device. These techniques provide students with convenient and accessible ways to extend their language proficiency in an accelerated manner.

Moreover, the use of digital mechanisms is far more aligned with open source or free subscriptions. Yet, a limited number of students have demonstrated an urge to learn languages through applications such as BBC Learning English, Dulingo, and English Pod101. Even though some are passionate about developing their skills, some neglect the opportunities to learn English. Their main reason was that they are currently learning in their mother tongue, and they hardly come across situations where they can use fluent English. In fact, this was observed beyond the metropolitan universities.

A fact that was realized through the discussions was that many students lack adequate support. Many students do not have access to the necessary technology, as not all

students possess computers or internet connections, as realized by going through the examples brought forth by the sample of the research. Most students were unaware of guidelines, methodologies, and assignment expectations to foster a structured and productive learning environment. Most of the students find it hard to trace the accent generated through digital devices, which have an automated robotic effect. Hence, the majority of the interactions in the virtual environment were teacher-initiated between the teacher and the whole class. The major reason is the language weakness of both lecturers and students. As such, most of the participants agreed that they were not resistant to students' usage of LI for any interaction, while five of the interviewees admitted that bilingualism is welcome in classrooms.

One of the major astonishing facts traced from the interviews of undergraduates was that the latest trend was using artificial intelligence to ease their tasks. Some students disclosed that they use applications such as Quillbot, Writely, openAI, Bard, and Pro Writing Aid. Instead of focusing on generating content by themselves or trying to compile the assignments by themselves, the undergraduates demonstrate a heavy dependence on artificial intelligence tools, which hinders their creativity and cognitive power.

Therefore, analyzing the content of the interviews, the research demonstrates that the students comparatively lack enthusiasm and encouragement to learn English via virtual environments, irrespective of all the efforts put in by the lecturers. Moreover, the majority of the students have the aspiration to learn English and raise their proficiency. Yet, many complain about the lack of time and access to resources, even though quality content is provided by their lecturers. On the other hand, the technical failures and inability to understand accents and monolingual classrooms also affect the quality of their teaching and learning processes.

#### IV. RECOMMENDATION

The research has shed light on the importance of addressing the barriers and limitations associated with technology integration in English language education. Accesses to the necessary technology, clear expectations, regular feedback, and patience and understanding from lecturers are vital factors for successful implementation. While the usage of digital techniques in teaching and learning English in virtual environments is growing, there is a need for further exploration and support to ensure their effectiveness. Future research can focus on strategies to improve digital literacy among students, provide professional development for lecturers, and assess the long-term impact of these digital mechanisms on English language proficiency. Overall, the findings of this research

contribute to our understanding of the current state of digital English language education in Sri Lankan state universities. By addressing the challenges and implementing effective digital strategies, educators can create a more engaging and dynamic learning environment, fostering improved English language proficiency among undergraduates.

#### V. CONCLUSION

In conclusion, this research paper has explored the utilization of technological devices for English acquisition processes in Sri Lankan state universities. The findings highlight the challenges faced by both lecturers and undergraduates in integrating digital approaches into language education. While lecturers attempt to incorporate digital games and discussion forums, they face limited success due to various factors, including the low level of digital literacy among students and the lack of support from undergraduates. Additionally, many students rely heavily on artificial intelligence and online translators to complete their English activities, seeking quick solutions rather than dedicated practice.

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# Understanding the Phenomenon of Brain Drain: An In-depth Analysis of the Emigration Patterns and Implications for IT Professionals in Sri Lanka

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**Abstract** – This research paper aims to comprehensively analyze the brain drain phenomenon within the context of IT professionals in Sri Lanka. The study delves into the emigration patterns and explores the underlying factors contributing to the outflow of skilled IT personnel from the country. Through a mixed-methods approach, including surveys, interviews, and data analysis, the research sheds light on the motivations and experiences of IT professionals who choose to leave Sri Lanka. Additionally, it examines the consequences of brain drain on the local IT industry and the broader economy. The findings highlight several key drivers behind the brain drain of IT professionals in Sri Lanka. Factors such as limited career opportunities, inadequate remuneration, lack of professional development prospects, and a perceived lack of recognition and support for IT expertise emerge as significant contributors. Moreover, external factors like immigration policies in destination countries and global demand for IT skills also play a role. The consequences of brain drain on the IT sector in Sri Lanka are multifaceted. On one hand, the loss of skilled professionals hampers the industry's growth and innovation potential. This research paper concludes with recommendations to address the brain drain challenge in Sri Lanka's IT sector. Policy interventions focusing on improving local career prospects, enhancing work environment conditions, fostering collaboration between academia and industry, and promoting a culture of innovation and entrepreneurship are proposed. These measures aim to mitigate the brain drain effects and create a conducive environment for IT professionals to thrive within Sri Lanka, ultimately benefitting the country's overall development and technological advancement.

**Keywords** - Brain drain phenomenon, IT professionals, mixed-methods approach.

## I. INTRODUCTION

Brain drain is the emigration of highly skilled professionals from one country to another due to various reasons. In Sri Lanka, the brain drain of IT professionals is a significant issue that has been affecting the country's development for many years.

Recently in Sri Lanka, there is a rapid brain drain of IT professionals mainly due to the economic crisis. With the Covid-19 pandemic and the economic crisis afterward, many IT companies couldn't offer what the IT professionals were looking for (1). Due to low payment of salary, low quality of their life, and political instability the IT professionals had to leave the country. This causes a huge loss to the country as Sri Lanka has one of the highest emigration rates among developing nations, according to World Bank research, with many talented professionals leaving the country in quest of better chances elsewhere. The research names the IT industry as one of the industries experiencing a particularly severe brain drain.

This assertion is also backed up by several additional investigations. For instance, a study conducted by the Institute of Policy Studies of Sri Lanka revealed that the country's IT sector is suffering from a serious lack of qualified workers, which is impeding the expansion and development of the sector. The brain drain was one of the primary causes of this shortfall, according to the report. The University of Colombo discovered in another study that the exodus of IT workers from Sri Lanka is a serious issue. The study concluded that a lack of employment options and low pay are driving many brilliant IT experts out of the nation.

According to the data, Sri Lanka is experiencing a serious problem with the brain drain of IT workers, which is having an adverse effect on the nation's progress. The government, the business sector, and other stakeholders will need to work together to address this issue by making more possibilities for qualified IT experts in the nation. This study is conducted by collecting real-time data from IT professionals who left Sri Lanka and those who are planning to migrate from Sri Lanka. Hence the survey includes the reason for their emigration. The study proposes practical solutions for how the IT professionals can be retained in Sri Lanka for a longer period.

## II. LITERATURE REVIEW

IT is a fast-moving industry that can nurture in any country. As IT competency is globally accepted, can be taught, and is

somewhat standardized, there seem to be more migration opportunities available for IT professionals. Considering a small country like Sri Lanka, the impact of migration can be multi-directional. Moreover, migration directly impacts the achievement of the IT industry vision for 2022 by taking IT talent out of the country. As per statistics extracted from WorldBank, Sri Lanka has the highest rate of total and skilled emigration in the South Asian region. The South Asian region has been growing in the aspect of its exports of both impersonal and personal services. The impersonal services enabled by Information Technology have been identified as a prospective driver for the development of the region. It recommends that the region has to provide opportunities for its people to acquire the required skills to meet the demands of these services industry (Dhar & Samanta, 2014).

There is an increasing trend in the migration of Sri Lankan professionals (Central Bank of Sri Lanka, 2015). Based on their high skill levels, there are more opportunities offered to them from foreign countries. Although this is earning foreign currency for the country, nowadays there are IT professionals who migrate permanently who do not contribute to the foreign currency earnings for Sri Lanka. Also, migration leads to the flow of innovative ideas and skills to foreign countries, rather than contributing to the development of Sri Lanka. Therefore, there is a necessity to identify the factors that are affecting the Sri Lankan IT professionals' migration, so that relevant authorities can refer to them and take remedial actions to retain the IT talents within the country. One of the challenges faced by the country is the loss of skilled IT professionals. It was mentioned that aligning the IT education curriculum with the current job market could be suggested as a solution. Also, Sri Lanka can produce many IT entrepreneurs by supporting them with the supply of proper guidance. This may help to create jobs and earn foreign currency for the country. (State Minister Kanaka Herath, 2023).

From most research, it is discovered that highly qualified people are migrating to high-growth economic countries where transitioning from the 'developing' phase to the 'developed' phase, e.g., Southeast Asia and Poland. More than 50% of skilled people are discovered to be migrating to Australia, Canada, and New Zealand with their families. (Global Commission on International Migration, 2005). Brain drains amongst the information and communication sector professionals has affected their targets of achieving USD 3 billion in export revenues by 2024 (CSSL).

From the past data, a relationship between brain drain and productivity growth could be identified that a large proportion of people (43.2%) related to the IT field are migrating from small developing countries, e.g., Sri Lanka. This happens because productivity growth in small

developing countries is more sensitive than in large one's changes happen due to brain drain. So, a negative impact occurred on productivity growth due to the brain drain of IT-skilled people in all developing countries (7.4%), and relatively it is mentioned as twice that of high-income countries (3.5%) (Schiff and Wang, 2008) Right now, there is a vacuum of about 20000+ IT professionals in Sri Lanka. Therefore, solutions must be started within the school by introducing IT into those underground levels which will benefit the brain drain issue in the country. (State Minister Kanaka Herath, 2023). Hence, it seems like a big challenge for developing countries including Sri Lanka to deal with brain drain as Sri Lanka is going through an economic crisis currently. Brain drains cause many considerable issues in the home country. Loss of tax revenue, loss of future entrepreneurs, shortage of important skilled workers, and loss of innovative ideas are identified as the worst issues. To overcome this, exchanging skills can be an effective solution.

### III. THE OBJECTIVE OF THE STUDY

To investigate the factors contributing to the migration of highly skilled IT professionals from Sri Lanka to other countries, the impact of brain drains on the IT industry in Sri Lanka, and potential policy interventions that could be implemented to mitigate brain drain and promote the retention of IT talent in the country.

### IV. METHODOLOGY

Professionals in the IT industry have shared their experiences working in Sri Lanka and their reasons for leaving or planning to leave. Some common reasons for leaving were lack of job opportunities in their field, personal or family reasons, and a desire for higher salaries and better quality of life. Respondents suggested that Sri Lanka could improve conditions for IT professionals by providing more job opportunities, training, and encouraging entrepreneurship. In terms of salary and benefits, most respondents reported that their current location was better than Sri Lanka. To improve conditions for IT professionals, the Sri Lankan government and tech industry could consider reducing taxes, increasing salary ranges, and improving infrastructure to attract foreign direct investment. Some professionals expressed interest in returning to Sri Lanka if conditions improve, while others had no plans to return due to personal reasons or a lack of confidence in the country's economic and political situation.

Additionally, improving infrastructure such as uninterrupted power supply and high-speed internet could attract more foreign direct investment in the IT industry. While some professionals expressed interest in returning to Sri Lanka if conditions improve, others had no plans to return due to personal reasons or a lack of confidence in

the country's economic and political situation. The data highlights the need for Sri Lanka to make significant changes to its economic and political structure to retain talented IT professionals and compete with other countries in the industry.

The data indicates that Sri Lanka's quality of life is not as good as other countries, and the cost of living is high. Many professionals mentioned that they are seeking a better quality of life and higher salaries in other countries. The data highlights the need for Sri Lanka to make significant changes to its economic and political structure to retain talented IT professionals and compete with other countries in the industry.

Real time data was collected through surveys and interviews which was then thoroughly analyzed using Python Programming Language and Microsoft Excel. This has allowed us to draw evidence-based conclusions and make informed decisions about the research findings.

*a. Dataset*

Real time data was collected through a questionnaire from the IT professionals in Sri Lanka who migrated recently. The dataset contains 14 columns and 68 rows. It contains 2 numerical data columns and 12 categorical data columns. The dataset was cleaned and filtered in excel.

Table 1. Dataset and its attributes

Column	Data Type
What is your IT related profession?	Categorical data
Age	Numerical data
Which country are you living currently?	Categorical data
How long did you work in Sri Lanka in the above profession?	Numerical data
What was your primary reason for leaving or planning to leave Sri Lanka?	Categorical data
If you are not planning to migrate, what is the reason?	Categorical data
Did you face any challenges in your profession in Sri Lanka that contributed to your decision to leave?	Categorical data
What opportunities are you seeking in your new location that you were not able to find in Sri Lanka?	Categorical data

Did you consider staying in Sri Lanka and working remotely for a foreign company?	Categorical data
What do you think Sri Lanka can do to retain talented IT professionals?	Categorical data
How would you rate the quality of life in Sri Lanka compared to your current location?	Categorical data
In terms of salary and benefits, how does your current location compare to Sri Lanka?	Categorical data
What do you think the Sri Lankan government or tech industry can do to improve the conditions for IT professionals in the country?	Categorical data
Are you planning to return to Sri Lanka in the future? Why or why not?	Categorical data

*B. Data Analysis*

The data was collected to an excel file. Then the excel file was converted to a comma separated version (CSV). The data analysis was done using python programming language. Hence, the data was imported to python.

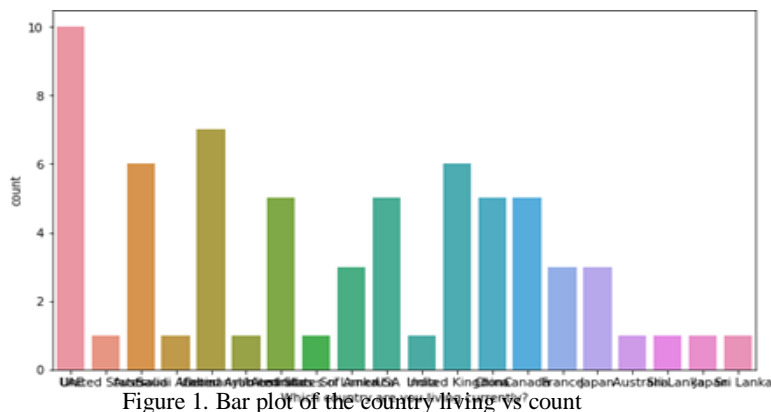


Fig 1. shows that most of the IT professionals are currently living in UAE. And least of them are currently in Sri Lanka.

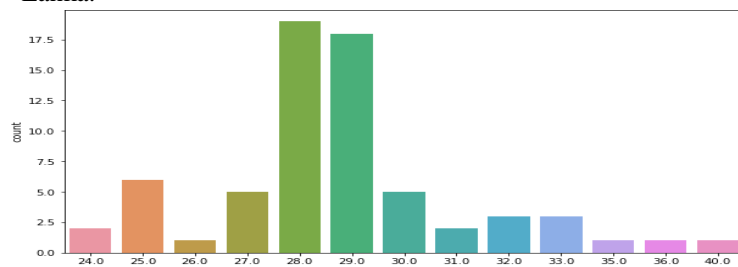


Figure 2. Bar plot of Age vs count

When age was taken into consideration, it shows that people of middle age which is 28 years old have fled recently. That is the age in Sri Lanka where people move to foreign countries looking for job opportunities.

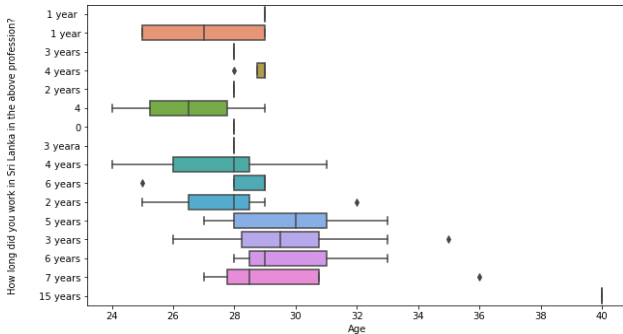


Figure 3. Boxplot of Age vs period of work in Sri Lanka

Fig 3. shows the variation between the age and the duration of work one has worked in Sri Lanka.

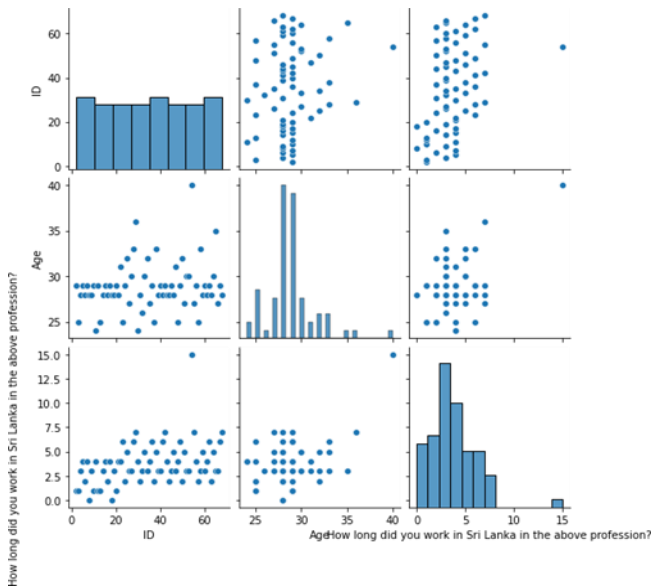


Figure 4. Pairplot

Fig 4. visualizes given data to find the relationship between the variables in the dataset where the variables can be continuous or categorical. Pairplot is a module of seaborn library which provides a high-level interface for drawing attractive and informative statistical graphics.

The analysis was carried out in excel for a sample dataset.



Figure 5. Bar plot showing the countries

The data shows that most of the respondents, which is three out of six, are currently living in the United Arab Emirates. This suggests that the UAE is a popular destination for Sri Lankan IT professionals who are looking to leave the country.

The UAE is known for its rapidly growing technology industry, which may be attracting Sri Lankan IT professionals seeking better job opportunities and higher salaries.

One respondent is currently living in the United States, one in Australia, and one in Germany. These countries are also known for their thriving technology industries and provide better opportunities for IT professionals. This could be one of the reasons why Sri Lankan IT professionals are seeking opportunities in other developed countries.

The data also indicates that Sri Lanka needs to improve conditions for IT professionals to retain them in the country. The fact that only one respondent is currently living in Sri Lanka suggests that the IT industry in Sri Lanka is facing significant challenges in retaining talented professionals. The government and tech industry need to provide more job opportunities, training, and encourage entrepreneurship to improve the conditions for IT professionals in the country. Additionally, improving infrastructure such as uninterrupted power supply and high-speed internet could attract more foreign direct investment in the IT industry.

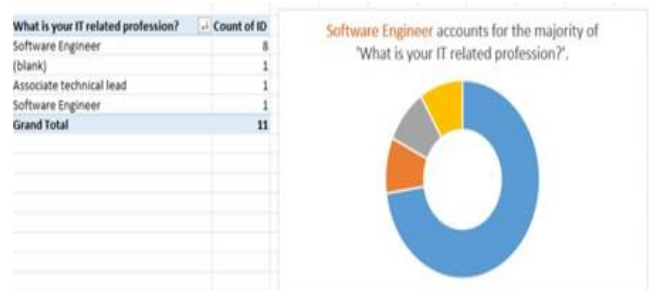


Figure 6. Pie chart showing the fields of IT professionals

The data suggests that most Sri Lankan IT professionals, who participated in the survey, are Software Engineers. This indicates that software engineering is a popular profession among Sri Lankan IT professionals. The high number of software engineers also suggests that Sri Lanka has a significant pool of talented software engineers who could contribute significantly to the growth of the IT industry in the country.

The fact that one respondent did not provide information about their IT related profession could indicate that there is a need for more diversity in the IT industry in Sri Lanka. The government and tech industry could focus on providing more job opportunities and training for other IT-related professions to promote diversity in the industry.

The data also highlights the need for Sri Lanka to retain its talented IT professionals. The government and tech industry need to provide better conditions and opportunities to retain such talented professionals. This could include providing more job opportunities, training, and support for the software engineering profession, and other IT-related professions.

Overall, the data suggests that Sri Lanka has a significant pool of talented IT professionals who have the potential to contribute significantly to the growth of the industry in the country. The government and tech industry need to focus on retaining these professionals by providing better conditions and opportunities to promote growth and diversity in the industry.

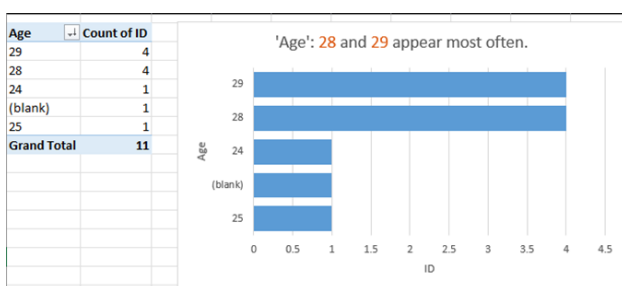


Figure 7. Age of respondents

The data shows that a significant proportion of the respondents are in their late twenties, indicating that this age group is a significant contributor to the IT industry in Sri Lanka. This suggests that Sri Lanka has a significant pool of young and talented IT professionals who could contribute significantly to the growth of the industry in the country.

The fact that one respondent did not provide information about their age could indicate a need for more diversity in the age groups of IT professionals in Sri Lanka. The government and tech industry could focus on providing more job opportunities and training for IT professionals in different age groups to promote diversity in the industry.

The data also highlights the need for Sri Lanka to retain its young and talented IT professionals. The government and tech industry need to provide better conditions and opportunities to retain such professionals. This could include providing more job opportunities, training, and support for the younger age group to promote growth and diversity in the industry.

Furthermore, the data suggests that Sri Lanka needs to focus on nurturing and retaining young talent in the IT industry. Sri Lanka has a significant pool of young and talented IT professionals who could contribute significantly to the growth of the industry in the country. The government and tech industry need to provide better

conditions and opportunities to retain such professionals and foster growth and diversity in the industry.

Overall, the data highlights the need for Sri Lanka to focus on retaining its young and talented IT professionals, provide more opportunities for different age groups, and promote diversity in the industry for sustainable growth.

## V. CONCLUSION

Brain drains of IT professionals in Sri Lanka is a complex issue with significant implications for the country's economy and technological development. This research paper has shed light on the underlying causes, consequences, and potential solutions associated with this phenomenon. The findings indicate that several push factors contribute to the brain drain, including limited career opportunities, low wages, inadequate infrastructure, and political instability. On the other hand, pull factors such as attractive job prospects, higher salaries, better work-life balance, and advanced technological environments in destination countries attract IT professionals to emigrate. The consequences of brain drain are far-reaching. Sri Lanka loses skilled individuals who could contribute to its economic growth, innovation, and technological advancement. Additionally, the outflow of IT professionals hinders the development of a robust IT industry and reduces the country's competitiveness in the global market. Several potential solutions have been identified to address the brain drain of IT professionals in Sri Lanka. Strengthening the IT infrastructure, fostering research and development, and promoting collaboration between academia and industry are also crucial steps. Furthermore, the government, private sector, and educational institutions must work together to enhance the quality of IT education, aligning it with industry demands and encouraging entrepreneurship. This can help create a thriving IT ecosystem that retains and attracts skilled professionals. mitigating the brain drain of IT professionals in Sri Lanka requires a comprehensive and multi-faceted approach. By addressing the underlying causes and implementing effective strategies, the country can retain its talent pool, foster technological innovation, and realize its potential as a global IT hub.

## VI. RECOMMENDATIONS

- i. Educating the youngsters about the job opportunities in Sri Lanka and giving them proper guidance through career guidance units.
- ii. Introducing novel opportunities in Sri Lanka related to IT fields.
- iii. Recognize and appreciate the contributions of IT professionals regularly. Implement an employee recognition program to acknowledge their achievements and provide rewards such as bonuses, incentives, or public recognition.
- iv. Offer competitive salary packages that align with

industry standards and the cost of living. Ensure that IT professionals feel adequately rewarded for their skills and experience.

- v. Providing proper trainings so that the IT undergraduates could gain hands on experience related to their fields.
- vi. Introducing to new courses and training materials that give them free learning opportunities to enhance their knowledge and skills on latest technological advancements.

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# The Effect of Utilising Poetry Translation Strategies in Poetry Translation: with Reference to Selected Published Poetry Translations from English into Sinhalese

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**Abstract**— Given its personal and concentrated nature, poetry falls under serious literature. When translating poetry, most translators follow literal translation method. As a result, the poet sometimes may fail to carry across the Source Language culture to Target Language culture. The issue is that it mostly does not preserve the aesthetic value of the translation. Hence, it is important to identify effective translation strategies for translating poetry. To investigate the effect of utilizing poetry translation strategies in poetry translation, the study selected published poetry translations which are literally translated from English to Sinhalese based on purposive sampling techniques followed by the theorists' interpretations on features of the literal translation procedure. The selected samples of poems were then again translated by the researcher using poetry translation techniques introduced by the Lefevere to investigate types of applicable poetry translation strategies, their level of effectiveness compared to literally translated poetry and afterwards the most effective poetry translation strategies. The reader responses were recorded by providing a questionnaire with an assessment criterion to evaluate literally translated poems and the poems translated incorporating strategies named as TT1 and TT2 respectively. It was highlighted that Rhymed Translation and Metrical Translation are more effective strategies to translate poetry after analyzing the data. Further, Interpretation and Poetry into Prose Strategies can also be given prominence in this study.

**Keywords**—Aesthetic Value, Effect, Poetry Translation, Strategies

## I. INTRODUCTION

### A. Background of The Research

Translation simply can be defined as transferring one language into another language. According to Newmark (1981), "translation is a craft consisting in the attempt to replace a written message and/or a statement in one language by the same message and statement in another language".

Thus, translation is an essential process to the present world. People are improving their qualities and they are getting new knowledge day by day. Due to globalization, information transmission has enlarged into vast spaces. When transferring information among people, translation plays a major role. Thereby, translation act aids in gaining and receiving information among different cultures. Thus, one cannot limit the importance.

Translation can be divided into two categories, namely, literary and non-literary translations. Literary translations are those in any part of literature that use words to create meaningful images, ideas, or stories. Novels, short stories, poetry, plays, actor's scripts are found under literary translation. Non-literary translations serve the primary purpose of conveying information, and they lack the narrative and fictional elements found in literary translations.

At present, people do their day-to-day work more inclined towards technology. While living that life, they have become technical tools. People have not been able to see a world beyond that. Therefore, literature is important to create a better world for human lives. Further, literature allows people to travel back in time and learn about life from those who have experienced before themselves. Here, culture plays a major role in this situation and translation is important to transmit information among cultures. Poetry is a way that forms such expressions. It is also a way that one can generate aesthetic values and present simple and complex frames of mind creatively.

There are a limited number of poets among many creators in the world. They are responsible for transmitting work among cultures. In this process, translations are important, and translators should make better outputs with regards to poetry translation. Nevertheless, the significant matter is that poetry is the most difficult genre of translation due to its extensive expressiveness. In poetry translation, the translator should be a poet himself and competent enough to make a better translation with a high level of creativity.



Then, the target reader can connect with the experience that has been based on the source audience.

Poetry paves way for thought generation. In translating poetry, the poet should have a clear perspective about the source language's culture, syntax, grammar and poetic tradition. In poetry translation procedure, the translator has to face some problems. Basically, it can be categorized into three as linguistic issues, aesthetic issues and cultural issues. In this procedure, translator should transmit source context to the target reader accurately and creatively. In the present day many published poetry translations on various platforms as books, magazines, newspapers and social media can be easily accessed. People read those translations, but there might be issues on understanding the accurate contextual meaning and the sense of poetry.

To overcome these transferring issues, poetry translation strategies are helpful. Many theorists have introduced poetry translation strategies to the discipline of Translation Studies. Among them Dryden (1965), Lefevere (1976), and Holmes (1970) are prominent. Lefevere has introduced seven strategies for poetry translation as Phonemic Translation, Literal Translation, Metrical Translation, Poetry into Prose, Rhymed Translation, Blank Verse Translation and Interpretation. According to Dryden, Metaphrase, Paraphrase and Imitation are acceptable. Holmes states that in general, no translation of poetry can occur without losses; however, the skilled translator is the one who produces a translation with no (or minimal) loss. In translation, the translator is confronted with various approaches or theories, and his skill lies in selecting the most appropriate approach that produces an adequate translation. Though the theoretical foundation on which the translator bases his work differs and varies with the various approaches to poetry, it all stems from two elements: content and form. Both of these factors should be carefully considered when translating poetry to ensure that the translation suffers the least amount of loss. When the approaches used by Holmes (1970) are viewed in this light, the first approach (of mimetic form) is found to be the most appropriate for producing an adequate translation, especially when the TL spirit is considered. (Eesa, 2004).

At this point, a translator need to determine the most effective ways to translate a poem. Apart from the prerequisites discussed earlier, a translator also has to employ translation strategies to incorporate his writing in order to ensure that the SL elements are catered towards TL elements. Thus, one should be aware that poetry translation is not an activity, but rather an expression of creativity. Therefore, while translating a poem, the translator transforms himself or herself into a poet otherwise the course would not be successful.

### *B. Problem Statement*

Translation refers to the art of reproducing a work from the source language (SL) into the target language (TL) while retaining its original flavour. When it comes into poetry translation, it is considered to be the most difficult genre of translation. In this procedure, translator has to reproduce Source Text into the most appropriate Target Text. In poetry translation, it is believed that there are more effective ways to translate poetry rather than being limited to word-to-word and literal translation. Through this research, the researcher aims to test the effectiveness of poetry translation techniques by retranslating the literally translated poetry by employing the translation techniques and analysing whether it creates an impact on the target audience. Accordingly, the research problem that the researcher intends to address in this research would be what is the effect of utilizing poetry translation strategies in poetry translation?

### *C. Research Questions*

- I. What are the types of poetry translation strategies that can be employed during a poetry translation?
- II. What is the level of effectiveness of literally translated poetry?
- III. What are the most effective poetry translation strategies?

### *D. Research Objectives*

- 1) Main Objective: To explore the effect of utilizing poetry translation strategies in poetry translation.
- 2) Specific Objectives: To identify the types of poetry translation strategies that can be employed during a poetry translation, to explore the level of effectiveness of literally translated poetry, and to identify the most effective poetry translation strategies.

### *E. Importance of the Study*

The significance of this research is to study the effect of utilizing poetry translation strategies in poetry translation. Poetry translation is still an under researched area in the local context. Therefore, this study will be useful for researcher's who are interested in studying about poetry translation.

### *F. Limitations of the Study*

The study's focus has only been on poetry translation. The study sample is restricted to selected published poetry translations on social media and published translated poetry collections. The researcher aims at addressing the issue only based on English to Sinhalese language pair. Moreover, the population involved for the study is only final year undergraduates who follow translation studies as their major subject and three subject lecturers. who specialize in Translation Studies.

## II. METHODOLOGY

Primary and secondary data were collected in this study. As primary data, published poetry translations from English into Sinhalese were selected by using the Purposive Sampling Technique. Accordingly, the data were selected using the interpretations given by theorists on features of literal translation procedure. Poems have been selected from the translated poetry collections, *Prēmayē Salpilēdī* by Ananda Amarasiri, *Sipum Sīrum Kenittum* by Lakshantha Athukorala and *Ādara Kavi Vissak saha Sun Pætum Gītāvak* by Lakshantha Athukorala. The researcher selected one stanza from each poem. These poems were chosen with the intention of seeing how far it is possible to translate poems using Lefevre's seven poetry translation strategies. Books, journal articles, reports, magazines and previously published research papers were used as secondary data. Moreover, primary data was further gathered from a questionnaire given to fifteen final year translation studies undergraduates and from interviews conducted with three lecturers who specialize in Translation Studies. As data analysis methods, this study employed both content analysis and thematic analysis methods. Analysis of translations was done under Lefevre's strategies for poetry translation.

## III. EXPERIMENTAL DESIGN

The researcher after selecting the poetry from ST and their parallel TT1 it was further aimed at analyzing errors and giving researcher's own translation for each ST as TT2. Each TT2 was translated according to above poetry translation strategies. Furthermore, the researcher made an assessment criterion and provided a questionnaire to the target group. The target group consisted of 15 final year undergraduates who follow Translation Studies as their major subject. Also, in addition, the researcher collected data through interviews from three lecturers who are specialized in Translation Studies.

The questionnaire includes two versions as literally translated poetry (TT1) and the self-retranslated poetry (TT2) by employing the other translation techniques. The respondents were given a rating scale the ST and two independent translations, TT1 and TT2 to evaluate using an evaluation criterion. To support the data, the researcher also conducted questionnaire-based interviews with three lecturers who specialize in Translation Studies. Moreover, the researcher incorporated secondary data to fulfil the research objectives.

## IV. RESULTS

The evaluation was undertaken according to reader's opinion and researcher's findings about poetry translation strategies. Lefevre's seven strategies of poetry translation were used as the base to determine poetry translation strategies in this study. This research is made up of

separate studies on the effectiveness of each strategy. TT2 poems have been translated according to, Phonemic Translation, Metrical Translation, Poetry into Prose, Rhymed Translation, Blank Verse Translation and Interpretation

Poetry was selected through books and social media. ST, TT1 and TT2 have been individually assessed according to, Content, Figurative Language, Form, Usage and Mechanics, Vocabulary, Tone, Usage of Translation Techniques.

### A. Strategies

The data which has been collected for this research are the poetry which are translated according to literal translation technique. Thus, the researcher explores the most appropriate poetry translation strategies in this section compared to literal translation.

ST- (Girl Lithe and Tawny - 1<sup>st</sup> stanza)

Here I love you.

In the dark pines the wind disentangles itself.

The moon glows like phosphorous on the vagrant waters.

Days, all one kind, go chasing each other.

TT1 - (නැඹිලි පැහැති සුනම්ස යුවතිය - 5<sup>th</sup> stanza)

ජරේම කරමි මම ඔබේ ජරිනිජනක සිරුරට,

ගලා හැලෙන සුකොමළ කටහඬට

කළු සමනලිය,

නිරිඳු යාය සහ හිරු මෙන් ද

පොපි කුසුම් සහ වතුර මෙන් ද

මිහිරි සහ නිශ්චල

TT2 – Researcher's Suggestion

අයාලේ දිවෙන දිය මන සළ ද දිදුලවන

අඳුරු ගල් යට සුළං රැළි වෙසිලු නැවැත්වෙන

එකින් එක ගෙවෙන දින එකිනෙකා ලුහුබදින

එ හැම දේ එක්ක මම තුඹට වෙමි පෙම් කරන

Firstly, the researcher has selected a stanza from Pablo Neruda's "Here I Love You" poem. It has been translated into Sinhalese by Lakshantha Atukorala as TT1. Here, TT2 is the researcher's suggestion and it has been translated according to Rhymed Translation. Repetition of syllables at the end of the verse line have emphasized the tone of the poetry. When considering poetry, rhyme is a basic poetic device. Adding that device into translation makes a major sense. It helps to generate musicality and emotions of poetry. According to another approach, Poetry's pulse is rhythm, and its echo is rhyme. Here, a well-crafted rhythm enhances both the aesthetic and emotional pleasure. A rhyme scheme, or rhyme pattern, also aids in the formation of the form. This can be accepted as an appropriate method for poetry translation.

ST - (Love - 1<sup>st</sup> stanza)  
 Until I found you,  
 I wrote verse, drew pictures,  
 And, went out with friends  
 For walks...  
 Now that I love you,  
 Curled like an old mongrel  
 My life lies, content,  
 In you...

TT1 - (ආදරය - 1<sup>st</sup>-2<sup>nd</sup> stanzas)  
 ඔබ හමු වන තුරු  
 මම කවි ලිව්වෙමි  
 සිත්තමි ඇන්දෙමි  
 යහළුවන් සමඟ ඇවිදින්න  
 පිටතට ගියෙමි

ඒත් දැන් ඒ මම ම  
 ඇමුතු සතෙකු සේ ගුලි ගැසී  
 ඔබට ආලය කරමි  
 තෘප්තියෙන් ජීවිතය  
 ඔබ තුළ ම සතපවමි

TT2 - Researcher's Suggestion  
 ඔයා දන්නවද ඔයාව හමිබවෙනකන් මම මොනවද  
 කරකර හිටියෙ කියලා? නැතේද? ඉතින් මං  
 කියන්නමි ඔයාට.. මං යාළුවො එක්ක ඇවිද්ද, එක  
 එක නැන්වල. කවි ලිව්ව, විතර ඇන්දා. මගෙ හිතට  
 ආපු හැමදේම ඇති ඒවගෙ. එකින් එක. ඔව්,  
 හැමදේම..  
 ඒත් මං දැන් ආදරේ කරනව. ඔයාට. ඒ හිටපු මම ම  
 නමා, හරියට ඇමුතු සතෙක් වගේ ගුලිගැහිල මං  
 ඔයාට විතරක්ම ආදරේ කරනව. ඔයාගෙම වෙන්න  
 හීන දකිනව. හරියට කවියක ජේලියක් වගේ මගෙ  
 වචනවලින් ලිව්වොත්, මෙන්න මෙහෙමයි,  
 "තෘප්තියෙන් මා ඔබ තුළ ම සතපවනු,  
 කැමැත්තෙමි මේ මං."

The poetry of "Love" has been written by Kamala Das. It has been translated into Sinhalese by Lakshantha Athukorala. According to TT1, it preserves the literal method. The reader is able to get a sense during their reading. . In TT2, the researcher has translated it as Poetry into Prose Strategy. Thus, it removes its' poetic sound and it is applying a story telling pattern.

The matter is that poetry, as opposed to prose, conveys a rawer experience. Poetry may employ more metaphors and indirect language to deliver an experience, but prose, in writing about the motions, allows for less interpretation. Thus, prose occurs to reduce communication quality, problems of formation of sentence patterns. According to Lefevere, this is not a successful translation strategy for

translating poetry, but there are no several issues in Poetry into Prose strategy. The translator can interpret the context of poetry as a prose.

ST – (3 Ghazal 74: dīvāna mīkunī dil-u jān-i kharāb-rā – 1<sup>st</sup> stanza)  
 You derive my ruined heart and soul insane  
 Don't twirl your hair in spot  
 And break those chains of pure musk

TT1 – (3.ගසල් කවි 74: - 1<sup>st</sup> stanza)  
 විනාශ වූ මහද හා ආත්මය  
 ඔබ ය උමතු කරවනුයේ.  
 කෙළි පිණිස කරකවනු එපා ඔය වරලස  
 නො බිඳින්න ඔය කස්තූර් දාමයන්

TT2 – Researcher's Suggestion  
 විනාස වෙච්ච මගෙ හදවනයි ආත්මෙයි  
 උමතු කළේ ඔයා  
 ඔහෝ කරකවනු එපා ඔය වරලස  
 බිඳින්න එපා ඔය මල්වල් ඒත් එක්කම

This stanza of "In the Bazar of Love" has been translated into Sinhalese according to Literal translation method. Considering it as poetry, it does not give an idea about poetic devices. Paradoxically, sounds and rhythms cannot be found in the poetry. There is a lack of usage in poetic devices. Then, the reader cannot experience poetry successfully. In TT2, the researcher has used Phonemic Translation technique. It focuses on the melody of sound. Therefore, the main purpose is to preserve the melody of sound in ST. Also, the context of ST has been transferred into TT which is also an aim in phonemic translation, but it creates a distorted context in TT. According to Lefevere, this is not successful.

ST - (The Maggots - 1<sup>st</sup> stanza, line no. 1-2)  
 At sunset, on the river ban, Krishna  
 Loved her for the last time and left...

TT1 - (ඉහද පණුවෝ - 1<sup>st</sup> stanza)  
 හිරු බසින විට  
 නදී ඉවුරෙහි  
 නික්මුණෙ ය කිරිණි  
 අවසන් වරට  
 ඇයට පෙම් කොට

TT2 - Researcher's Suggestion  
 පුන් සදක සද රැස් වැටුණු  
 යහනෙ නිදි ඇය ද පුතු  
 බැලී සිදුහත් එදෙස සැරයක්  
 පළමු හැර යන්නට එ ගිහිගෙය

ST has been translated into Sinhalese according to literal translation, but the researcher's suggestion is interpretation. In this strategy, translator imitates ST and

reinvent a poem as TT2. When referring ST, it is written based on the Indian context. In TT1, the translator has translated it into Sinhalese with that Indian context, but in TT2, the researcher suggests that it is better to imitate for Sri Lankan culture. After interpreting ST as TT2 into Sinhalese, it is closer to Sri Lankan Buddhist reader. Therefore, interpretation is a successful poetry translation strategy.

ST - (White Bee - 1<sup>st</sup> stanza)

White bee, you buzz in my soul, drunk with honey,  
and your flight winds in slow spirals of smoke.

TT1 – (ධවල මීමැස්සිය - 1<sup>st</sup> stanza)

ධවල මීමැස්සිය, ආසවයෙන් මත්ව,  
ඔබ මගේ ආත්මය තුළ ගුමුගුමු නංවයි  
ඔබේ පියසැරිය මද දුම රැල්වලින් පවත්  
සලයි

TT2 - Researcher's Suggestion

ශ්වේත මී මැස්සියනි, ම'තුළ ඔබ මුමුණුන - බිමත්ව  
සිටින්නී මී පැණින් ඔද වෙන  
නුඹ පියාසැරියම දුටුවවුන් පිනවෙන - දඟර ගැසී  
දුමක් මෙන් ලතාවට රඟ දෙන

In this instance, the researcher has employed the Metrical Translation strategy. ST has been translated into Sinhalese according to a literal method. When considering TT2, it gives the poetic sense more than TT1. It preserves the meter of ST successfully, but here, TT2 preserves only meter of the poetry. Because of this reason, sometimes it is not an effective translation strategy.

*B. Evaluation of Questionnaire*

15 final year Translation Studies undergraduates participated in this questionnaire. According to their responses with regard to the questionnaire, conclusions can be drawn separately for TT1 and TT2.

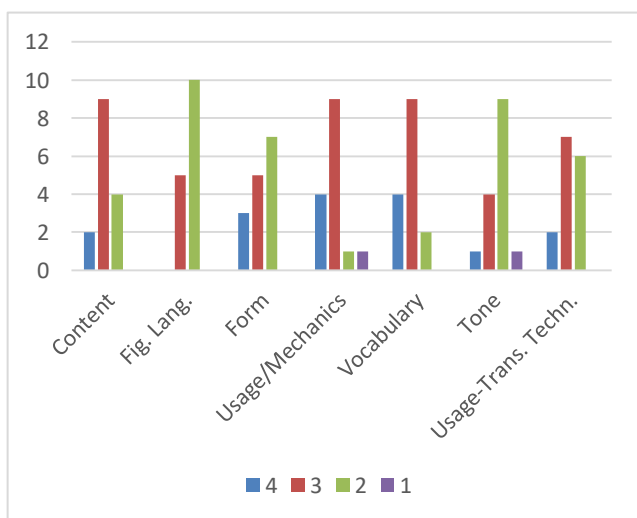


Figure 9. TT1 Responses

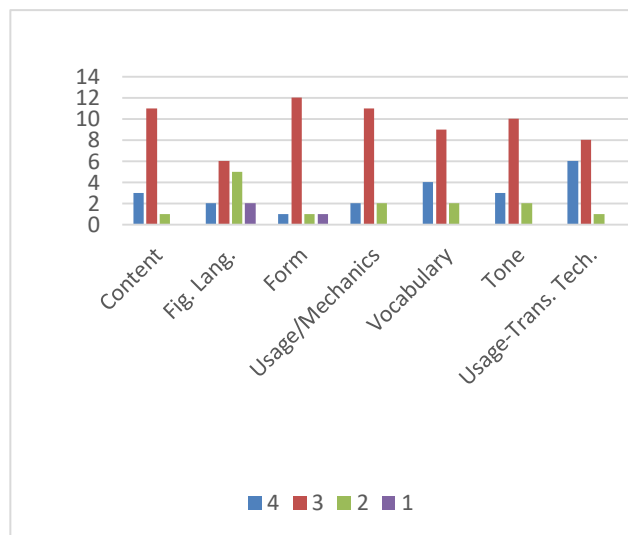


Figure 10. TT2 Responses

*C. Evaluation of Interviews*

Three lecturers who specialize in Translation Studies participated in this interview. The researcher recorded responses separately for each poem and lecturers' responses were focused on the technical aspect of TT1 and TT2. Principally, Metrical Translation is the most effective strategy in poetry translation according to participants. Due to the poetic vocabulary, the imaginary is at a high level in metrical translation and tone is preserved in it. Consequently, Metrical Translation is an exquisite translation strategy for poetry translation. The Rhymed Translation highlights that, it can preserve figurative language, but it does not reflect ST accurately. Therefore, it cannot be considered as a perfect translation method. In Interpretation, the translator imitates ST and recreates a new poem. In Poetry into Prose, the translator alters the form of the poetry into the form of prose. As independent poetry, the poetry written by using interpretation strategy and poetry into prose strategies create aesthetically valuable poetry, but in both strategies, it remakes poetry. Hence, they are not translations, but recreations. However, in particular aspects as cultural aspects, both strategies are effective in poetry translation.

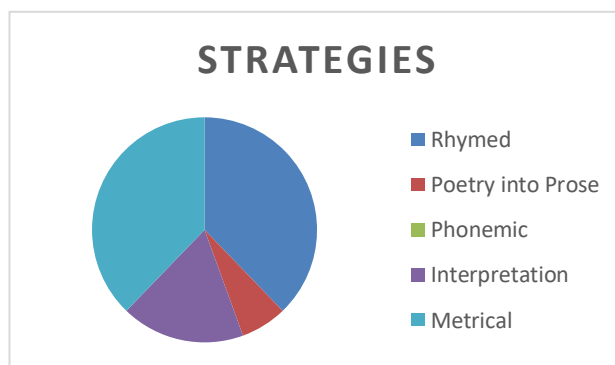


Figure 11

Based on the overall evaluation of the effectiveness of poetry translation strategies, the researcher herewith conclude the final statement. The researcher discovered mistakes in the sample poetry translations. Then, as previously discussed, the researcher was able to identify issues and difficulties that readers, as the target audience, and poets, as translators, had to face. After using various strategies, the researcher has proved that Metrical Translation is an effective poetry translation strategy among Lefevere's seven strategies for poetry translation because it preserves all aspects of a poetry translation when it comes into English-Sinhalese poetry translations. Rhymed translation can also be a successful strategy for poetry translation when the translator preserves the content of the ST. A victorious poet can execute an effective rhymed poetry translation. In addition, Interpretation and Poetry into Prose can be used in poetry translation in particular aspects. Accordingly, it can be logically identified about the effectiveness of poetry translation strategies from English into Sinhalese through this study.

#### V. DISCUSSION AND CONCLUSION

The purpose of this study is to evaluate the effectiveness of poetry translation strategies from English into Sinhalese by evaluating samples from published poetry translations. The researcher has obtained a sample in which researchers use their knowledge to select specific participants who contribute to the study in order to achieve its objectives. The sample texts were taken from published English-Sinhalese poetry translations. As a result, the research question was formulated as "What is the effect of utilizing poetry translation strategies in poetry translations from English into Sinhalese?" As research questions, this study is expected to determine the types of poetry translation strategies that can be used during a poetry translation, the level of effectiveness of literally translated poetry, and the most effective poetry translation strategies. The researcher anticipated in identifying the above objectives by analyzing poetry translations and collecting responses from the target audience via questionnaires and interviews. Finally, based on all of the facts investigated throughout the course of this research, it has provided answers to the research problem and the remaining research questions in order to achieve the desired results. This study discovered that Lefevere's poetry translation strategies can be applied to poetry translations from English into Sinhalese. However, in order to produce a work of creativity in poetry translation, translators should be free to follow their own paths or in other words their creativity in employing strategies in translations, and most of the time, the translator himself or herself should be a poet. Furthermore, translators have the freedom to alter the structure of sentence patterns in order to preserve poetic language. In conclusion, the results of this study's questionnaire, interviews, and researcher's analysis show

that Rhymed Translation and Metrical Translation are highly effective as poetry translation strategies. Apart from that, after determining the target audience and the purpose of the translation, the Interpretation and Poetry into Prose strategies can also be used depending on the nature of TA.

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#### ABBREVIATIONS AND SPECIFIC SYMBOLS

- SL – Source Language
- ST – Source Text
- TL – Target Language
- TT1 – Target Text 1
- TT2 – Target Text 2
- TA – Target Audience

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# Sri Lankan English as the Standard/ Model for Language Assessment in English Language Teaching in Sri Lanka: Understanding Tertiary Level Teacher Resistance

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**Abstract** — Although the argument for adopting periphery varieties such as Sri Lankan English (SLE) as the standard for English Language Assessment (LA) has been established both in the World Englishes scholarship and by prominent Sri Lankan scholars, there has been considerable resistance to this suggestion by academics and teachers. Thus, this study investigates why English teachers resist adopting SLE as the Standard/ model for LA in English Language Teaching (ELT). The study adopts a qualitative approach since similar studies of quantitative nature have been conducted. The study collected data from 10 teachers who teach English at two Faculties (Humanities and Social Sciences as well as Natural Sciences) at a state university through semi-structured in-depth interviews. The collected data were coded and then analysed using the method of thematic analysis. Seven themes explaining teacher resistance to SLE as the model/ standard in LA in ELT were identified through the analysis of data: SLE as ungrammatical and unacceptable outside Sri Lanka, teachers' sense of professional responsibility to train the students in "correct" language usage, lack of awareness regarding variation within SLE, difficulties arising in marking student answers due to lack of codification of SLE, image as a competent teacher and pressure from the academic community, SLE as unacceptable in the domain of English for Academic Purposes and accepting SLE as the standard as discriminatory against students whose mother tongue is Tamil. The study highlights the importance of further research, particularly of qualitative nature, on SLE as the standard in other practices in ELT such as material development and pedagogy.

**Keywords** — Sri Lankan English, TESL, Language Standards

## I. INTRODUCTION

Among theoretical and ideological concerns that have been addressed in the scholarship of World Englishes (WE), the question of language standards or models of English is uniquely relevant to English language teaching (ELT) contexts traditionally designated "non-native", such as Sri Lanka. The field of WE advocates not only recognition to all varieties of English in the world where English is used as a second/ additional language, i.e. considered "not-native", but also points out that these varieties are not inferior or "deficient" (Kachru, 1996, p. 56) when compared with "native" varieties such as British or American English,

either structurally or in terms of their socio-cultural relevance. Thus, the WE scholarship also argues that ELT should adopt language models/ standards which are locally and regionally relevant (Kachru, 1996, p. 56). In the case of countries like Sri Lanka, this implies - at least in the theoretical sense - that all ELT practices including Language Assessment (LA) should be reimagined in terms of Sri Lankan English as the Standard/ Model.

The question of SLE as the model/ standard is a crucially important question in the area of Language Assessment which is a practice in ELT that involves developing tests and marking rubrics as well as rating student written and speech performance against a certain language variety as the model/ standard. Scholars such as Parakrama and Meyler prescribe SLE as the standard/ model for teaching English in Sri Lanka for several reasons. Parakrama (2010) is of the view that the English education system in Sri Lanka should adopt a language variety which is familiar to the students and that this cannot be achieved through a variety of English which is alien and alienating, such as British or American English (p. 92). Meyler (2015) also argues in a similar vein when he points out that it is "unrealistic and unfair to test students' English ability according to an alien and outdated standard" (p. 182).

However, there has been a fair amount of criticism and disagreement towards SLE as the standard/ model as well. For instance, the *English Our Way* programme introduced to the Sri Lankan school system in 2009 was discontinued amidst criticisms of falling standards of English (Bernaisch, 2012). Some scholars too criticise SLE in its relevance in the field of ELT in Sri Lanka, pointing out that it is a "substandard variety" (Fonseka, 2003). Studies on teacher attitudes towards SLE as the standard/ model in ELT, also highlight teachers' reluctance to accept SLE as the standard. For instance, Medawattegedera and Devendra's study (2004) involving 55 school teachers finds that teachers are more inclined to accept SLE in students' speech rather than in their writing. And in a more recent study involving 50 school teachers, it was found that 77% teachers believe that British English in the standard variety (Amunugama et al, 2019).

While the acceptance or rejection of SLE as the standard/ model for LA is largely a question of language ideologies



and attitudes by gatekeepers such as teachers, the number of studies on attitudes towards SLE are very few, however. And even the few studies that do explore this question have been conducted in the context of state schools involving school teachers and largely quantitative methods of data collection. Since these studies are largely quantitatively oriented, they report the reluctance of teachers to accept SLE as the standard/ model in ELT only in a numerical sense. They do not adequately explore reasons for their resistance, nor focus on reasons for their reluctance within the context of LA in ELT. This study therefore fills this research gap in several ways: the study involves perspectives of English educators on SLE as the standard/ model in the context of LA in a state university setting. It also focuses on qualitative methods of data collection and analysis for more nuanced findings. The research question guiding this study is as follows:

*Why do tertiary level English educators resist adopting Sri Lankan English as the Standard/ model for language assessment practices in English language teaching?*

## II. METHODOLOGY

In this section, particulars regarding the research site, research participants, design of the study, methods of data collection and analysis are discussed.

### I. Research Site and Participants

The study was conducted in a state university in Sri Lanka. Data was collected from 10 educators teaching English at two Faculties (Humanities and Social Sciences as well as Natural Sciences) of the said university.

### II. Research Design

Research Design was primarily qualitative, since studies of quantitative nature have been conducted.

### III. Data Collection and Analysis

Semi-structured in-depth interviews were conducted to collect data to investigate English educators' resistance towards adopting SLE as the model/ standard for LA practices. The interviews were first transcribed and the data was then analysed using the method of thematic analysis.

## III. RESULTS

The transcribed data from the interviews were categorized under seven themes. These themes that explain teacher reluctance to accept SLE as the standard/ model for LA, are as follows:

### I. SLE as ungrammatical and unacceptable outside Sri Lanka:

One reason that teachers were reluctant to accept SLE as the standard/ model for LA, was the belief that SLE is ungrammatical and that SLE is not an acceptable variety of English especially in countries outside Sri Lanka. Due to these reasons, the teachers were reluctant to adopt SLE as the standard. These opinions are clear in the following comments by the teachers:

“SLE forms are grammatically wrong. We can't accept that kind of writing and speech as correct.”

“SLE is not accepted out there.”

*Teachers' sense of professional responsibility to train the students in “correct” language usage:*

Closely linked with teachers' belief that SLE is ungrammatical and not accepted internationally, is teacher's sense of professional responsibility to train students in “correct” language usage. The teachers believed that by assessing students' language production as SLE as the standard, the teachers would not be preparing students in terms of the reality of English locally nor internationally. The teachers' viewed SLE as an inferior variety which will not be accepted neither in Sri Lanka's in the corporate sector, nor in academic and professional settings in countries outside Sri Lanka. Thus, the interviewees were of the opinion that it was their moral and ethical obligation to train their students in “correct” language usage, which in their opinion, was not SLE:

“SLE will not even be accepted in Sri Lanka's corporate sector”

“We will be doing a disservice to the students by not teaching them proper English.”

“It's my job to assess students according to the kind of language that is acceptable out there.”

“Do you think SLE will be acceptable when these students migrate and they have to work and live in foreign countries?”

*Lack of awareness regarding variation within SLE:*

The teachers' view of SLE as non-standard/ungrammatical in and of itself signals at the teachers' lack of awareness of variation within SLE such as Standard SLE and non-standard SLE which is also derogatorily called “not-pot English” (Gunesekera, 2010, p. 35). It can be observed that teachers' lack of awareness on variation within SLE causes other issues for them when they have to judge/ assess varietal features as “correct”/ “acceptable” and “incorrect”/ “unacceptable” when occurring in students' writing/ speech. Thus, it can be surmised that teachers' reluctance to accept SLE as the standard in LA stems from their lack of awareness regarding a.) variation within SLE, b.) status of varietal features in SLE:

“Some SLE features are grammatical and some are not. So SLE is confusing. Especially when we have to mark students' work.”

### *I. Lack of codification:*

Another reason for teacher to resist SLE as the standard/ model in LA in ELT is the lack of codification of SLE. The teachers pointed out that when it comes to questions regarding students language production especially in writing, they refer to resources with information on American and British varieties of English. For instance, dictionaries and pedagogical resources adopt British or American English varieties as the standard and the participants of the research pointed out that information on SLE is not so conveniently available. According to the teachers, this causes difficulties for them when rating/ marking student answers.

“There aren’t even dictionaries on SLE. How can we check if something is correct in SLE?”

### *II. Image as a competent teacher and pressure from the academic community*

It was found that teacher reluctance to accept SLE as the standard/ model in LA is influenced to a great extent by their perceptions of a competent teacher as well. Due to their perception of SLE as substandard, the teachers believed advocating SLE as the standard in LA will mark them as incompetent teachers:

“I can’t accept SLE as the standard when marking student answers. I am able to distinguish between good English and bad English and SLE is just not it.”

The teachers were also worried about negative judgments from the academic community they operate in, if they were to accept SLE as the standard in their LA practices. This belief was particularly prominent in educators teaching English in Faculties of natural sciences.

“We have to keep up the standards. Otherwise we will lose the footing [in the academic community]”

“If students can’t even speak grammatically doing a presentation or write a report in good language because we passed them, the blame will be on us.”

“SLE is not accepted in the academic community”

### *III. SLE as unacceptable in the domain of English for Academic Purposes*

Another reason for teachers to reject SLE in LA was the belief that SLE is not relevant in the domain of English for Academic purposes (EAP). Since English teaching in the university contexts involve EAP, teachers were reluctant to accept SLE as the model for LA:

“SLE is not acceptable as the standard when it comes to English for Academic Purposes”.

### *IV. Accepting SLE as the standard as discriminatory against students whose mother tongue is Tamil*

Another theme that emerged when investigating teacher reluctance to accept SLE as the standard/ model in LA in ELT, was the view that doing so would discriminate students whose mother tongue (L1) is Tamil. They were of the opinion that many documented and accepted features of SLE have originated from Sinhala and that forms of SLE originating from Tamil have neither been adequately researched nor considered intelligible by teachers whose L1 is Sinhala. Given these reasons, the teachers were of the opinion that accepting SLE as the standard/ model in LA, would discriminate against students whose L1 is Tamil:

“If we accept SLE as the standard, Sinhala students’ pronunciation errors and direct translations will be accepted but what about Tamil students?”

“SLE is not neutral”

## IV. DISCUSSION AND CONCLUSION

The findings of the research expands the understanding of the relevance of SLE both in ELT in general as well as in LA, in several ways. Firstly, the study reveals that one of the main reasons for the view of SLE as non-standard/ ungrammatical and inferior to other varieties of English, could be the lack of awareness regarding the variation within SLE and extremely negative attitudes towards the so-called “non-standard” varieties within SLE. It can also be observed that the difficulty faced by educators in distinguishing between the standard and non-standard varieties of SLE, makes it harder for them to make judgments on student language performance, i.e. in LA. While the existence of “standard” versus “non-standard” varieties is a natural phenomenon of language, in the case of SLE, the “non-standard” variety is viewed by teachers as stigmatized and therefore particularly unsuitable for LA in ELT.

The second observation that can be made is with regard to the impact of the academic community/ institutional requirements on standards of ELT. The belief that SLE cannot be accepted as the model for LA, was prominent among English educators particularly from natural sciences. This finding not only highlights the prestige occupied by varieties such as British and American English in natural sciences, but it also evokes questions of the role of the English educator within such teaching contexts.

Thirdly, the findings of the study also points at the inadequacies of the research field of SLE itself, particularly with regard to codification and forms of SLE that are of Tamil origin. This is an important finding that is relevant for future research in the field of SLE as well.

While this study provides several useful insights on SLE as the standard/ model for LA in ELT, it should also be noted that the findings are limited since the data was collected from

teachers of one state university in Sri Lanka. In order to fully understand and appreciate the relevance SLE as the standard/ model for LA in ELT, further research involving English language teachers from non-state tertiary level educational institutes and also policy makers, is also necessary.

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Pedagogy as well as Language Teaching.

# Effectiveness of teaching vocabulary using PPP approach in a blended learning environment

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**Abstract** - Vocabulary is getting updated in daily basis and teachers' role is vital in teaching vocabulary to the learners in the language classroom. Blended learning is a method that combines face to face learning and online learning where teachers can use virtual classrooms such as webinar and chat forums and platforms such as Zoom, Teams and Google Meet which support online education. Blended learning allows learners to utilize the ability to increase the engagement in a more student centric environment. With the development of modern technology, blended learning looks strong, and all signs point to its continued growth as more educators and students realize its benefits and provide easier communication methods within a digital classroom setting. When teaching vocabulary through blended learning, teachers can use online tools such as Padlet, Kahoot, Flipgrid, Mentimeter and Wordwall to teach vocabulary activities as it maximizes learning goal achievement by utilizing the appropriate learning methods to match with appropriate learning desires in order to deliver the relevant skills to the individual at the right time. Face to face classes maintain the liveliness meanwhile virtual platforms aid students to expose with a wide range of materials available online as well as it is outdated to teach vocabulary entirely using either online or offline mediums. To fulfill every student's specific needs, blended learning utilizes the best elements of both traditional and digital learning approaches. In this study we will demonstrate how blended learning approach can be implemented in a PPP vocabulary lesson and discuss how effective blended learning approach in teaching vocabulary.

**Key words:** Blended learning, Vocabulary teaching, Online tools

## I. INTRODUCTION

Learning vocabulary is an ongoing endeavor that is included in the learning process because it is the foundation of all language skills (Cecilia, 2016). Even people who exhibit an ability of grammar may struggle to communicate without a broad vocabulary and having a limited vocabulary range may hinder the one's language development (Tosun, 2015). Vocabulary assists language learners in creating meaningful phrases and expressions. With numerous researches, it has been shown as well to be strongly linked to L2 acquisition (Tosun, 2015).

As a result, enough support is required in its learning, and blended learning may be the technique that supports

vocabulary continual teaching and learning due to the benefits it offers in both traditional classes and online learning (Cecilia, 2016). It has become increasingly popular in recent years to use computers in language instruction. According to Krajka (2002) & Kilickaya (2007) (as cited in Pazio, 2010. P: 3), several studies have reported that not all learners are prepared to use computers in place of teachers, classrooms, and textbooks entirely. Therefore, blended learning approach in which both face-to-face and online instructions are combined has become the alternative that is becoming preferred among language teachers (Pazio, 2010).

Presentation Practice Production approach is one of the prominent approaches to teach vocabulary. According to Longman (1997 as stated in Nopiyadi et al, 2023. P:15004), The presentation stage is when novel items are first introduced, their definitions are clarified, they are shown, and another relevant knowledge is provided. b) New things are practiced alone or in groups during the practice stage. Practice sessions typically transition from controlled to uncontrolled practice. c) During the production stage, also known as the transfer stage or free practice, students use new materials more freely with little to no teacher supervision. All the procedures required to develop vocabulary knowledge, including noticing, repetition, and creative usage, are covered by the blended method (Pazio, 2010). The present study investigates how blended learning approach can be integrated in the PPP model when teaching vocabulary, the effectiveness of using blended learning approach in teaching vocabulary based on a review of articles and issues pertaining to this area with further recommendation.

## II. TEACHING AND LEARNING VOCABULARY

"Teaching vocabulary is one of the most important aspects of language instruction, as it plays a crucial role in language acquisition (Cameron, 2001). Language of a person basically depends on the vocabulary which also includes basic language units such as pronunciation, vocabulary and grammar (Pan & Xu, 2011). Vocabulary lays the foundation to reading comprehension, reading fluency, writing, and in interacting with others (Asselin 2002, and Nichols & Rupley 2004. as cited in Alshwiah, 2010). Enhancing the proficiency in vocabulary helps the learners to use the language in various matters (Alshwiah, 2010). Teaching and

learning the vocabulary of a second language helps to get a better understanding of the difference between two cultures (Zheng, 2012). Knowing the culture of a second language helps the learners to understand the real meaning of specific words through having the awareness on the native speakers' way of thinking (Zheng, 2012). Culture teaching and learning improves the metaphorical competence that enhances students' language learning (Zheng, 2012). Metaphorical competence includes soft skills like creative intellectual ability. It also helps the learners in developing their cognition (Zheng, 2012). Teaching vocabulary also enhances learner autonomy during their learning process (Zheng, 2012). In learning the vocabulary teacher is the knower and students have to follow the instructions that are given by the teachers (Zheng, 2012). Linguistics state that teaching vocabulary using technology-based instructional materials in engaging written and verbal communication are far more beneficial (Tsaturova et al., 2007; Zhdanko, 2011; Dolinskiy, 2012; Veledinskaya & Dorofeeva, 2014; Grishaeva, 2015. as cited in Dinara et. al., 2016). The internet and Virtual Learning Environments (VLEs) can be utilized to support vocabulary acquisition, as they have shown positive effects on language learning. In today's teaching environment, there are various methods available to teachers, but blended learning has emerged as one of the most popular approaches, driven by rapid technological advancements (Butler, 2013). Due to that, language teachers are influenced to use blended learning technology by today (Vasbieva et. al., 2016).

### III. BLENDED LEARNING APPROACH

Foreign language teachers all over the world are becoming increasingly interested in the blended learning approach. Blended learning refers to the addition of various forms of technology-based instruction to the traditional face-to-face teaching and learning environment, as opposed to pure e-learning, which refers to using just electronic media to study (Tosun, 2015). So, this strategy might be described as combining online learning with traditional classroom training. Virtual learning environments (VLEs) support blended learning, which, in accordance with Huang and Chiang (2010, as cited in Ginaya et al., 2018), is flexible in the learning resources it offers and promotes online collaboration between students and instructors. The usage of blended instruction is expanding quickly because, teachers think that using a variety of delivery strategies can greatly improve learning results and raise student satisfaction with the educational process, (Lim & Morris, 2009). Lu, 2008 studied two groups of high school students in Taiwan who received two sets of English terms either on paper or via SMS messages over the course of two weeks to determine the effectiveness of SMS vocabulary training on the small displays of mobile phones. After reading the regular, concise SMS courses, students learnt more vocabulary during the post-test than they did after reading the substantially more in-depth print material. According to research results based

on questionnaires, kids prefer using a mobile phone to acquire language. Similarly, comparing two groups of students at a Chinese university, Zhang, Song, and Burston (2011) conducted a comparative study on the effectiveness of vocabulary learning via mobile phones. According to the study's conclusions, "students can learn vocabulary more effectively short-term via mobile phones than with paper material," they were able to confirm. There are very few empirical studies in the literature that found that students' academic success was unaffected by blended learning education.

### IV. PPP APPROACH

The PPP approach, which was developed in the United Kingdom in the 1950s and is based on behaviorist methods of instruction, quickly gained popularity in the field of language education and was used by the majority of language teaching institutions (Maftoon & Sarem 2012). As Nopiyadi et al (2023) indicate, PPP, which stands for *presentation, practice, and production*, is a three-part teaching approach with a clearly defined lesson method. Criado (2013) identifies the PPP technique as a paradigm for activity sequencing that is used in the majority of foreign language teaching course books. Tomlinson (2011. As cited in Criado, 2013. P:98) provides a precise specification of this model as, "an approach to teaching language items which follows a sequence of presentation of the language item, practice of the item in a controlled manner and then production or the use of the item". The PPP method was adapted by structural teaching methods and developed into a successful method of teaching language structures (Criado, 2013. P:98). According to Hammar (2001. As stated in Maftoon & Sarem 2012. P:31), PPP approach was recommended for trainee teachers as an effective method. Maftoon & Sarem (2012) explicate that the PPP technique employs the deductive method, in which the teacher explicitly explains and introduces grammatical structures during the presentation stage without allowing students to recognize the grammatical structures or the language items while Criado (2013) shows that inductive or deductive methods can be used for new language item presentation. Several studies have revealed criticisms of the PPP paradigm (Maftoon & Sarem, 2012).

Criado (2013) in his study, explains the three main stages of PPP approach as follows,

*Presentation phase (P1)* – The target language structure or lexical items are presented and explicit explanations are provided in this phase. Both a deductive and an inductive approach can be used in this presentation. In deductive approach, the instructor or textbook provides an explanation of how the target structure or lexical item was built or means. In the inductive mode, often known as "discovery learning," teachers or materials give students examples of vocabulary or structural elements that have been contextualized in spoken or written texts. This is provided as

the input in the mode of reading text or listening text. The underlying concepts and meanings must be inferred by the students.

*Practice phase (P2)* – This stage provides highly controlled practice on target structure or vocabulary, during which the teacher examines the understanding of the presented new language item or items in the presentation phase. The tasks in this stage are designed to increase accuracy.

*Production phase (P3)* – The stage attempts to improve linguistic fluency specifically through "autonomous and more creative activities". Learners get the opportunity to produce the language freely using the target structures. Discussions, role-plays, information or opinion gaps, debates and problem-solving activities can be implied in this production stage.

#### V. APPLYING BLENDED LEARNING APPROACH IN TEACHING VOCABULARY THROUGH PPP APPROACH.

The first stage of *PPP approach* is presentation in which the teacher begins the lesson by establishing a situation and either asking for or demonstrating appropriate language to introduce the topic (Maftoon & Sarem, 2012). For example, *teaching vocabulary related to hotel stay* can be taken as the context or the topic. In the lead-in stage teacher can do vocabulary brainstorming activity by asking learners to list down the words related to hotels in groups in a face-to-face classroom or create a word cloud through *mentimeter* tool by asking learners to type the words related to hotels in an online class. Presentation stage includes model sentences and short conversations showing target items may be read from the texts, heard on tape, or acted out by the teacher (Maftoon & Sarem, 2012). Here in the input stage, teacher can introduce the target vocabulary in context by providing a reading or listening text with some comprehension questions to check the overall understanding of the text in a face-to-face or online classroom. For example, in a face-to-face classroom reading text on the transcription of a conversation between hotel receptionist and customer on *booking a hotel room* can be provided with comprehension questions in a handout while in an online classroom learner can listen to the conversation using their own devices and do the comprehension checking activity in a *padlet* in which learners can type the answers. In order to introduce the target words teacher can ask learners to underline, circle or highlight words related to hotel in the given handout in face-to-face class or by sharing the handout in the screen in an online platform like Zoom or Teams to make learners annotate in the online class. To check if the learners understand the meaning or the use of target words, categorizing activity can be used in a face-to-face class as a collaborative work in groups while *wordwall* can be used as an online tool to categorize the underlined words in the online classroom. For example, teacher can create the

categorization activity in the wordwall in which learners have to drag and drop the words into correct category. In order to introduce the pronunciation of the target words, a video clip containing both the word and its spelling, as well as the letter associated to sound highlighted when pronouncing, can be used by the teacher. To present the form of target words, the teacher can distribute jumbled letter cards and ask students to arrange them to teach spelling in either a face-to-face or online lesson.

In the second stage of the PPP approach, known as the *practice stage*, students practice the new vocabulary or language structure they have learned, in context in a controlled way (Maftoon & Sarem, 2012). Teacher can ask learners to select the most appropriate response to the provided multiple-choice questions in order to help them practice the target words in a more controlled manner. In an online class teacher can design this activity in an available online platform like *wordwall*. Moreover, the teacher can ask learners to listen to a telephone conversation and then ask them to fill in the gaps in the sentences that are provided to give them controlled practice in the listening mode either in a face-to-face class or in an online class.

According to Maftoon & Sarem (2012), the last stage is the *production stage*, in which the teacher introduces a similar setting, and the students are encouraged to use the new language more freely for their own goals and meanings or in that context. It could be a role-playing exercise, a simulation activity, or a communication task. Teacher can make learners practice the target words freely in the mode of speaking by producing language. For example, teacher can ask learners *to imagine that they going to a hotel on a vacation and build up a telephone conversation with the receptionist* in pairs and present, in a face-to-face classroom and give feedback. In addition, to provide freer practice through writing teacher can use an online discussion forum like *padlet*. As homework, a teacher can assign learners to imagine that they stayed at a hotel and write a review of the hotel stay in a padlet and ask each learner to post feedback to their peers in the padlet. In this way blended learning approach can be utilized effectively to deliver a vocabulary lesson in PPP model.

#### VI. EFFECTIVENESS OF USING BLENDED LEARNING

An instructional strategy called blended learning, commonly referred to as hybrid learning, mixes traditional face-to-face classroom instruction with online learning activities. It combines the advantages of on-campus and online learning, giving students a flexible and interesting learning environment. According to the study done by Bernard et al., (2014), the effectiveness of blended learning in higher education contexts was investigated by a meta-analysis. Comparing pure face-to-face instruction or online learning on its own to mixed learning approaches, the study indicated

that the latter had a negative effect on students' academic performance. Moreover, it was discovered that tailored learning opportunities and active student involvement were created in blended learning environments, producing successful educational outcomes (Hew & Cheung, 2014). The study done by Rahimi & Yadollahi, (2016) examined how blended learning affected the vocabulary development of English as a Foreign Language (EFL) students. The findings demonstrated that as compared to traditional classroom instruction alone, blended learning greatly improved vocabulary learning. Similarly, Masita (2020) investigates the use of blended learning in vocabulary instruction. It is a case study, and information was gathered through a combination of interviewing and observing. Thirty learners who were enrolled in the English education program's first year of the English language learner class participated in the study. A vocabulary class where the instructor used a blended learning approach to instruction. The findings showed that a blended learning strategy based on vocabulary instruction increased learner engagement, and using other online tools like *Plickers* and *Quizizz* increased interest as well. When using mobile devices on vocabulary acquisition, Chen et al., (2008) suggested that blended learning approaches, including the use of mobile devices, were effective in improving vocabulary learning outcomes. Moreover, Djiwandono (2013) states that it has been well known that vocabulary learning can be divided into two main categories: deliberate vocabulary learning and accidental vocabulary learning and he investigates how blended learning approach can be used to enhance college students' vocabulary learning and the study was carried out in an academic environment where intentional learning is prioritized. The study explicated that there is a considerable improve in their vocabulary mastery with the use of this blended learning and the approach was "highly favored by learners". Even the blended learning approach is beneficial in enhancing vocabulary and overall oral communication skills in English (Gu & Hu, 2013). According to the study done by Lee & Park, 2017 explored how well blended learning helped Korean English as a Foreign Language (EFL) students develop their vocabulary. The results showed that blended learning had a positive impact on vocabulary learning and retention. In addition, Meng & Lin, 2020 studied how blended learning affected Chinese non-English major students' ability to learn English vocabulary. The findings showed that students' vocabulary knowledge and retention were greatly improved via blended learning.

These studies offer proof that blended learning is an efficient method for teaching vocabulary. They suggest that including online components in conventional classroom training can improve language learners' vocabulary learning and retention.

## VII. ISSUES AND RECOMMENDATIONS

There are certain challenges and issues that educators may encounter when implementing this approach. Blended learning heavily relies on technology, such as computers, internet access, and learning management systems. Inadequate technological infrastructure can hinder the effectiveness of the approach, particularly in schools or regions with limited resources (Hew & Cheung, 2013). Blended learning requires students to take more responsibility for their learning, which can challenge their motivation and self-regulation skills. Without proper guidance and support, students may struggle to stay engaged and motivated (Broadbent & Poon, 2015). Designing effective vocabulary lessons in a blended learning environment involves careful planning and selection of appropriate instructional strategies. It is essential to align online and offline activities seamlessly, ensuring that they complement and reinforce each other (Hartman, Moskal, & Dziuban, 2018). Providing timely and meaningful feedback to students in a blended learning setting can be challenging. Traditional methods of assessment may not be sufficient, and educators need to explore innovative ways to assess and monitor vocabulary learning (Gikandi, Morrow, & Davis, 2011). Blended learning requires reliable internet access and access to appropriate devices. Issues related to the digital divide, such as socioeconomic disparities and uneven access to technology, can limit the effectiveness of blended learning in reaching all students equally (Hrastinski, 2009). These challenges and issues highlight the importance of careful planning, ongoing support, and pedagogical considerations when implementing blended learning for teaching vocabulary. If digital tools are chosen in accordance with students' requirements and interests, blended online vocabulary education could be successful in assisting EFL learners in improving their vocabulary knowledge (Tosun, 2015 & Vasbieva et al 2016). Tosun (2015) recommends that, for selecting most effective online tools and activities for each distinct group of learners, needs analysis should be done.

## VIII. CONCLUSION

In conclusion, due to its effective learning outcomes, blended learning is currently used to make the teaching process successful. Combining traditional face-to-face instruction with online learning in one location is known as blended learning. It is also noted as a novel idea in education. The development of one's vocabulary in a second or other language is crucial for improving one's linguistic proficiency. The primary goal of the current review article study was to investigate the efficacy of teaching vocabulary through blended learning, and it was explained that the vast majority of studies have demonstrated that this method is helpful for enhancing vocabulary learning in a variety of scenarios. While there are not many actual studies in the literature that show blended learning, instruction has no impact on students' academic achievement. This study also covered the drawbacks of employing blended learning and



how both internal and external factors might influence how this strategy is used. Future recommendations will be helpful if the researchers focus on the problems that come up while putting blended learning into practise. More research has to be done to explore the use of blended learning approach to teach vocabulary in an inclusive classroom with a diversity of learners is one of the proposed research topics.

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# Technology Mediated Vocabulary Assessment in Second Language Teaching

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**Abstract**—This study explores the concept of technology-mediated vocabulary assessment in second language instruction, concentrating on how technological tools and resources might improve the assessment process and give useful feedback to students. With the introduction of digital platforms, software programs, and online resources, educators now have access to a wide range of innovative techniques for evaluating students' vocabulary knowledge and skills. This study examines the different facets of technology-mediated vocabulary evaluation, including online tests such as the Expressive One-Word Picture Vocabulary Test (EOWPVT), The British Picture Vocabulary Scale (BPVS), Peabody Picture Vocabulary Test (PPVT) and Test of Word Knowledge (TOWK). Moreover, vocabulary applications, digital flashcards, corpus tools, natural language processing (NLP), and online dictionaries. These systems provide dynamic, individualized learning experiences, instant feedback, and the capacity to monitor students' development over time. The incorporation of technology in vocabulary assessment not only improves learner engagement and motivation, but also gives teachers insight into their students' lexical knowledge, helps them to spot their areas of weakness, and allows them to modify their lesson. While acknowledging the advantages of technology-mediated vocabulary assessment, it is vital to make sure that these tools are applied in a way that is in line with instructional objectives and delivers reliable and accurate assessment results. The purpose of the study's conclusion is to highlight the importance of using technology in second language assessment in order to maximize vocabulary learning and foster successful language learning.

**Keywords**— **Vocabulary, Assessment, Technology, Tools**

## I. INTRODUCTION

In the context of teaching second languages, technology-mediated vocabulary assessment refers to the use of online tools, platforms, and applications to evaluate students' vocabulary growth. It involves using technology to produce dynamic, interesting, and tailored assessment experiences that meet the various needs of language learners (Sung & Chang, 2021). Vocabulary assessment in the teaching of second languages is made easier by the use of digital tools and platforms, which include a wide range

of educational resources. These tools include interactive websites, computer-based tests, virtual reality modeling, language learning apps, online quizzes, and more. It gives students immersive, interactive assessment experiences that are rich in technology (Zou et al., 2020). Individual needs and interests of learners are taken into account while creating a personalized assessment method. Technology-mediated vocabulary assessment provides possibilities for flexible evaluations, immediate feedback, and personalized learning pathways based on students' performance and progress (Hu et al., 2018). The complexity of vocabulary implies complex assessment. One test is not enough to determine the vocabulary level because of the multiple facets of vocabulary. Different points need to be resolved when dealing with vocabulary assessment (Dujardin & Auphan & Bailloud & Ecalle & Magnan, 2021). This study aims to identify effective technology mediated vocabulary assessment tools that can be practically applied in the ESL classrooms.

## II. VOCABULARY LEARNING AND TEACHING

Vocabulary learning is central to language acquisition, whether the language is first, second, or foreign (Decarrico, 2000). A vital part of language ability is vocabulary, which allows people to express themselves clearly and accurately. Language acquisition and growth depend significantly on both learning and teaching vocabulary. Vocabulary learning and teaching is a collaborative process, where both teachers and learners actively engage in the exploration of words (Carter & McCarthy, (2006). Vocabulary is the key that unlocks the doors to effective communication in a new language (Nations, 2001). Learning vocabulary is an essential aspect of learning a second language (L2). It is essential for the growth of language proficiency as a whole as well as specialized abilities like speaking, listening, reading, and writing (Nation, 2013). Learning new terms and their definitions requires active engagement on the part of the learner. Exposure to a range of real-world language materials is the first step to effective vocabulary learning. Learning in context, where students come across words in their natural surroundings, aids in the development of a better comprehension of word usage and distinctions. Even though learners master all grammatical areas in the language, the communication stops when they do not know the necessary word (Farjamani et Assadi, 2013). To enable

effective vocabulary training, educators must use a variety of strategies and techniques during the dynamic process of teaching vocabulary. By giving students relevant and interesting circumstances, exposing them to rich language input, and encouraging active engagement, teachers can create a learning environment that is conducive to vocabulary learning. Teaching vocabulary is like planting seeds; with nurturing and cultivation, it grows into a blossoming language proficiency (Schmitt, 2008). It is suggested that teaching vocabulary should not only consist of teaching specific words but also intend at equipping learners with strategies necessary to expand their vocabulary knowledge (Hulstijn, 1993, cited in Morin & Goebel, 2001). Teaching vocabulary involves creating meaningful and memorable encounters with words, building lasting connections in learners' minds (Hiebert & Kamil, 2005). Contextualized learning, word analysis, and active involvement are all components of effective vocabulary learning and teaching methodologies. Contextualized learning provides the scaffolding learners need to make vocabulary meaningful and memorable (Brown, 2007). Learners can improve their vocabulary acquisition by applying techniques including in-depth reading, utilizing context clues, making word connections, and using flashcards or vocabulary applications. According to (Stockwell, 2007), incorporating technology in vocabulary learning amplifies engagement and enhances learner autonomy. Moreover, the use of pre-teaching crucial vocabulary, explicit instruction, encouraging the meaningful use of words through discussions and writing exercises, and integrating vocabulary development across many subject areas are some of the strategies used by teachers.

### III. HOW TO ASSESS VOCABULARY

The assessment of a language's vocabulary is a crucial since it reveals the word knowledge and linguistic skills of the learners. By conducting an effective vocabulary evaluation, teachers may determine the extent of students' vocabulary acquisition, pinpoint areas that need work, and then modify their instruction accordingly. Vocabulary assessment plays a vital role in the language education process where the educators assess students' individual performances, knowledge and improvement regarding a particular subject area with the use of different types of tests. According to (Arisian & Russel 2008 as cited in Cahyo 2022), the goal of vocabulary assessment should be to assess a student's word knowledge on both a receptive (understanding) and productive (use) level. It should take into account how well students can understand words in context, use them correctly, and determine meanings. Vocabulary assessment can be categorized into formative and summative approaches. Formative assessments are used to identify areas for progress, provide continuous feedback, and guide instructional decisions. Quizzes on

vocabulary, class discussions, and instructor observations are a few examples of such methods of assessment. Summative assessments, which are completed at the end of a unit or course, assess students' overall vocabulary proficiency and may include extensive vocabulary assessments or assignments (Mcalpine, 2002). Different teaching strategies include vocabulary Quizzes, Vocabulary journals, Vocabulary tests, contextualized assessments, vocabulary projects, collocation assessments, self-assessment and reflection and technology mediated assessments. Most testers agree that there is a place for measuring both knowledge and use in second language assessment. Another dichotomy in the vocabulary literature is whether to test high frequency words or more specialized technical vocabulary (Coombe, 2015). For classroom assessment, Mihai (2010) categorized it according to intention, purpose, interpretation, and administration. Therefore, one more category of assessment may be added to those modes (oral or written). The method of assessment varies depending on the subjects and purposes of the assessment. Language testing is different from testing in other content areas as language teachers have more alternatives to make (Brown & Hudson, 1998). Brown and Hudson (ibid) identified three basic assessment types: (a) selected-response which includes true-false, matching, and multiple-choice assessments, (b) constructed response which includes fill-in, short answer, and performance assessments, and (c) personal-response which includes at least conference, portfolio, and self- and peer assessments. Fundamental principles for evaluating and designing second language assessment include validity, reliability, practicality, equivalency, authenticity, and washback (Tran, 2012).

### IV. TECHNOLOGY MEDIATED LANGUAGE ASSESSMENT

Technology Mediated Language Assessment (TMLA) has largely influenced the field of Language Assessment at present (Sadeghi & Douglas, 2023). Large scale and high stakes tests are aided with the technology in many ways (Ockey & Neiris, 2021). For example, test administrators and examinees have been connected remotely through online platforms and video mediated technology (Ockey & Neiris, 2021). Also interlocutors and human administrators can be replaced by technology (Ockey & Neiris, 2021). These technologies provide several benefits for assessment such as increasing the engagement of the test takers, recording learner's strategies, easy to implement in the classroom, and providing adaptive tools (Dujardin et al., 2021). According to Chua & Don, (2013); Kucirkova et al., (2017 as mentioned in Dujardin et al., 2021) use of multimodal items provide the attractive aspect for the test, so it improves the test takers engagement and motivation in the task. Also Singleton (2001, as mentioned in Dujardin et al., 2021) technology mediated assessment involves different facets of engagement rather than traditional paper

and pencil test. Also sufficient guidance for the test takers is provided by the interactive nature of the computer based tools (Dujardin et al., 2021). So according to Protopoulos & Skaloumbakas (2007, as mentioned in Dujardin et al., 2021) this autonomy impact on increasing the test takers' level of engagement. Jeong (2014, as stated in Dujardin et al., 2021) computer based tools enable to record multiple measures which provide opportunity to track the behavior of the test takers. According to Gill et al. (2015 as mentioned in Dujardin et al., 2021) practitioners can identify the different strategies of the test takers by using simultaneous interpretation of correct answers and response times. Also computer based tools are easier to implement (Dujardin et al., 2021) and according Schatz & Brownlyke (2002, as stated in Dujardin et al., 2021) test scores can be computed and recorded automatically. Moreover it enables the specific evaluation in collective sessions (Dujardin et al., 2021). Based on the success and failure of responding to the initial items computer will propose different items and study how apps can be adapted to individuals (Dujardin et al., 2021). So according to Tseng et al. (2006, as stated in Dujardin et al., 2021) adaptive testing enhances the accurate evaluation than traditional testing. Moreover Tseng et al. (2006, as stated in Dujardin et al., 2021) state that greater discrimination among the performance levels of the test takers will be provided by adaptive testing. Also these features are applicable in developing a detailed and accurate profile of learners in terms of language skills such as reading and vocabulary (Dujardin et al., 2021).

#### V. METHODOLOGY

The systematic review was conducted in three phases. First, the researchers conducted a thorough search for research articles on technology-mediated vocabulary assessment tools. Second, they selected relevant studies based on a set of criteria. Finally, they conducted an in-depth review of the most relevant studies.

Here is a more detailed explanation of each phase:

- Phase 1: Search for research articles: The researchers used a variety of databases to search for research articles on technology-mediated vocabulary assessment tools. They used keywords such as "vocabulary assessment," "technology," and "computer-assisted language learning."
- Phase 2: Select relevant studies: The researchers used a set of criteria to select relevant studies. These criteria included the following:
  - The study must have used a technology-mediated vocabulary assessment tool.
  - The study must have reported the results of the assessment tool.
- Phase 3: Conduct an in-depth review: The researchers conducted an in-depth review of the most relevant studies. This involved reading the studies carefully and summarizing the findings.

#### VI. UTILIZING TECHNOLOGY MEDIATED TOOLS FOR ASSESSING VOCABULARY IN ESL CLASSROOM

Vocabulary assessment requires a range of tests to assess different vocabulary dimensions such as depth, size and fluency based on various cognitive parameters such as oral or written, receptive or productive and also assessing general words or specific words (Dujardin et al., 2021). There are several existing computer-based tools to specifically assess the breadth and depth of the vocabulary (Dujardin et al., 2021). Some computer-based tools to assess the breadth of vocabulary and the significance of them are discussed below.

- *Expressive One-Word Picture Vocabulary Test (EOWPVT)*

The One-Word Picture Vocabulary Test (EOWPVT) measures receptive vocabulary in both adults and children. It is a one-on-one test that assesses a person's comprehension of the meaning of words by using visuals. The EOWPVT is frequently used to evaluate language development, spot language errors, and monitor progress over time in educational and professional settings (Martin and Brownell, 2016). This test includes 190 stimuli which are applied individually, in groups of people with 2 to 80 years of age, organized and articulated at an ascending level of difficulty that is, starting with the easiest concepts. The evaluation should be interrupted when there are six consecutive errors (Silva et al., 2021). This helps researchers and professionals to get expressive vocabulary of spoken language in which the subject must name with only one word, objects, actions, or concepts using colorful illustrations (Silva et al., 2021). This test is composed of short verbal stimuli (e.g., what is he doing?), spoken aloud by the examiner and test takers are required to provide short verbal responses (e.g., swimming) by the subject promoting rapid application. It lasts about 20 minutes (Silva et al., 2021).

- *Peabody Picture Vocabulary Test (PPVT)*

The Peabody Picture Vocabulary Test (PPVT) is one of the most common vocabulary tests in use today. The PPVT is a hands-on test that evaluates a person's comprehension of word meaning by using visuals. The PPVT is commonly used to evaluate language development, spot language errors, and track advancement over time. This test is used to measure receptive vocabulary of an individual or how well a person understands spoken English (Eigsti, 2021). Examinees see a page on an easel with four color pictures. The examiner says a word for each item, and the examinee responds by selecting one picture out of four which demonstrates that word's meaning (Eigsti, 2021). The test requires no reading, writing, or expressive verbal language as the examinee points out the relevant item and it can be used with nonreaders and those are not fluent verbal abilities (Eigsti, 2021). The test is individually

administered and untimed (Eigst, 2021). In total, the PPVT contains 228 items, divided into 19 “sets” of 12 items each; an examinee completes all items within a set (Eigsti, 2021).

### 3) *The British Picture Vocabulary Scale (BPVS)*

A standardized examination of receptive vocabulary for both children and adults is the British Picture Vocabulary Scale (BPVS). It is comparable to the EOWPVT, but it utilizes British English words and images. The BPVS is also commonly utilized in clinical and educational contexts. There are 176 items in this, which are organized in descending difficulty. Every item displays an image, and the examiner says something. Then, the kid or adult is asked to indicate the image that most accurately depicts the word's definition. It takes 20 to 30 minutes to administer the test (Dunne & Dunne, 2007). This is an evaluation of a child's or adult's performance in comparison to that of others the same age and gender. A mean of 100 and a standard deviation of 15 are used to express the standard score. A kid or adult who receives a score of 100 is considered to be performing at the age and gender-appropriate level. A child or adult is performing within the usual range if their score falls between 85 and 115 on the scale. An adult or child may have a language delay if their standard score is lower than 85 (Secord & Wiig & Semel, 2004). It has been identified to be a valid and dependable indicator of receptive vocabulary. The test has been demonstrated to be reliable over time and to correspond with other measures of language proficiency (Martin & Brownell 2005).

## VII. ISSUES AND RECOMMENDATIONS

The test method which simply means ‘how we measure?’ has a direct relationship with ‘what we measure?’ which describes the construct or ability of the test (Sadeghi & Douglas, 2023). Using different methods to measure the same test construct will result in different performances which demonstrate various levels of ability (Sadeghi & Douglas, 2023). Differences in performances are impacted by gender, age, cultural background, the interaction between the test taker and interlocutor and the linguistic proficiency of the test taker (Sadeghi & Douglas, 2023). So when computer medium is added to these prevailing complexities and even a slight difference in the method of delivering the test can impact on the changes of the performances (Sadeghi & Douglas, 2023). Although the current pandemic forced assessments to move towards technology mediated assessments, the issues such as fairness, security, ethics, practicality and authenticity and washback of the technology mediated assessments should be considered (Sadeghi & Douglas, 2023). Also validity and fairness issues are tend to exist in the regions which technologically disadvantaged (Sadeghi & Douglas, 2023). Technology mediated language testing programs require fixed mechanisms to update software, hardware and the

employees need to gain the technological knowledge (Chapelle & Voss, 2018).

Here are some practical approaches for using existing technology-mediated vocabulary assessment tools in ESL classrooms:

- Choose the right tool for the type of assessment. There are many different technology-mediated vocabulary assessment tools available, so it is important to choose one that is appropriate for your needs. Consider the level of your students, the type of vocabulary you want to assess, and the features of the tool.

- Use the tool in conjunction with other assessment methods. Technology-mediated vocabulary assessment tools should not be used as the sole method of assessment. Instead, they should be used in conjunction with other methods, such as oral interviews, written tests, and student self-assessment.

- Integrate the tool into your lessons. Don't just use the tool at the end of a unit or lesson. Instead, integrate it into your lessons so that students can use it to track their progress and get feedback on their learning.

- Provide students with support. Not all students will be familiar with using technology-mediated vocabulary assessment tools. Be sure to provide them with support so that they can use the tool effectively.

- Use the results to inform your instruction. The results of technology-mediated vocabulary assessment tools can be used to inform your instruction. Identify the areas where your students need more support and adjust your lessons accordingly.

## VII. CONCLUSION

At present, language learning, teaching and assessment procedures are tend to incorporate existing computer based tools. There are various computer based tools to assess vocabulary based on different dimensions and cognitive parameters. Technology mediated vocabulary assessment involves several benefits and provides different facets for a test than traditional forms of test. The computer based tools increase the engagement of the examinees, enable easy implementation, record scores automatically and identify the different strategies of the test takers. Also there are issues and limitations which can affect the aspects such as fairness, practicality, implementation and maintenance of the computer based vocabulary assessment procedures. So the researchers always focus eventually on how the existing tools can be adapted according to minimize the issues and challenges of the Technology Mediated Vocabulary assessment. Despite these challenges, Technology Mediated Vocabulary Assessment holds the potential to completely transform the assessment of second language vocabulary. And it is used as a method for assessing second language vocabulary and is likely to expand as technology develops.

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# Intelligent Traffic Management System (ITMS) for the development of smart cities in Sri Lanka

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**Abstract** - Traffic congestion in Sri Lanka is a pressing issue that leads to wasted time, financial burdens, and disruption of personal schedules. The inadequate road infrastructure, underutilization of various travel information sources, and transportation systems coupled with the increasing number of vehicles contribute to this problem. Despite the presence of two international airports, a railway system, and waterways for transportation, the populace predominantly relies on the road network, leading to consequential challenges such as traffic accidents, property damage, and environmental pollution. The objective of this research is to put forth and assess a smart system for managing traffic known as the Intelligent Traffic Management System (ITMS). This system utilizes technological progressions like Artificial Intelligence (AI), cloud computing, the Internet of Things (IoT), and data analytics to enhance traffic management and control. The objective is to optimize traffic flow, reduce wait times, alleviate congestion, minimize travel expenses, and mitigate air pollution levels. The proposed system employs machine learning algorithms to forecast optimal routes based on traffic patterns, vehicle classification, frequency of accidents, and weather conditions. The development and implementation of the ITMS demonstrate the potential of AI-driven solutions in addressing traffic-related problems and improving daily commuting experiences. In conclusion, integrating AI technologies into the ITMS presents a promising approach to mitigating traffic congestion challenges in Sri Lanka. By forecasting optimal routes and incorporating data-driven decision-making, the ITMS offers a solution to improve traffic management and alleviate the negative effects of congestion.

**Keywords**— *Traffic Congestion, The Intelligent Traffic Management System, Artificial Intelligence*

## I. INTRODUCTION

Have you ever wondered how a traffic light functions? Interestingly, artificial intelligence (AI) plays a crucial role in its operation. In Sri Lanka, the escalating volume of both rural and urban road traffic has led to numerous traffic-related issues such as traffic jams, accidents, and environmental pollution (Dharmaratne, Jayatilleke, & Jayatilleke, 2015). However, the application of AI, specifically programmatic AI, has significantly enhanced traffic management in both rural and urban areas

worldwide, mitigating accidents and alleviating traffic congestion.

### A. Artificial Intelligence

Artificial Intelligence encompasses a broad spectrum within the field of Computer Science-based topics where humans build smart machines with the use of human intelligence (Russell & Norvig, 2016). Artificial Intelligence (AI) refers to systems or robots that simulate human intellect and possess the ability to continuously enhance their performance based on the data they collect. Francois Chollet, a prominent researcher at Google specializing in Artificial Intelligence and the creator of the Keras machine learning library, highlights the connection between intelligence and a system's ability to extrapolate knowledge and effectively navigate unfamiliar circumstances through adaptation and improvisation. John McCarthy, renowned for his exceptional contributions to the fields of Computer Science and Artificial Intelligence, is widely acknowledged as the "father of Artificial Intelligence". In the mid-1950s, McCarthy introduced the term "Artificial Intelligence," providing a definition for it as the field focused on developing intelligent machines that can demonstrate cognitive abilities. McCarthy first used the phrase "Artificial Intelligence" in the middle of the 1950s and he did characterize it as "The Science and Engineering of making Intelligent Machines." Artificially intelligent robots made their initial appearances in Science Fiction literature during the early 20th century. Notable examples of such characters include the unfeeling Tin Man from "The Wizard of Oz" and the humanoid robot, portrayed by Maria, in the film "Metropolis." The concept of Artificial Intelligence (AI) had deeply influenced scientists, mathematicians, and philosophers of the time, becoming firmly entrenched in their thinking by the 1950s(Anyoha,2017).

In 1956, John McCarthy and Marvin Minsky organized the Dartmouth Summer Artificial Intelligence Study (DSRP AI), which marked the significant milestone of the first official AI program being included. The software created during the Dartmouth Summer Artificial Intelligence Study (DSRP AI) is commonly acknowledged as the initial step in the development of Artificial Intelligence. While the trajectory of AI remains uncertain, this research underscores the substantial gap between the

current state of AI and its depiction in science fiction (McCarthy, J., Minsky, M., Rochester, N., & Shannon, 1956).

### *B. Intelligent Traffic Management System*

Despite the significant efforts to enhance and improve traffic flow in many nations, including several countries with advanced economies, traditional traffic lights continue to experience the following well-known issues.

- a) They offer ineffective traffic control at intersections. This makes commuters who drive to work irrationally which in turn results in traffic congestion, pollution, more delays, etc.
- b) They lack adaptability and cannot acquire intelligence. Currently, regardless of the volume of traffic or flow density, each route is given a certain percentage time frame to be green at intersections. By not allocating time in accordance with traffic congestion, this results in inefficient traffic flow. Some roads could be busier than others at certain times of the day, making it take longer to clear congestion. However, this feature cannot be offered by a conventional traffic light.
- c) To eliminate needless waiting until the ongoing timer expires as described in the first two points, a signal that instantly closes once there are no longer any vehicles on the road in a junction and opens up the following road is required.
- d) Some environmental conditions such as rain, fog, and the like, do not protect them. As a result, they might not function properly or be visible in these circumstances. Accidents and fatalities result from this.
- e) They lack a system for granting emergency vehicles (such as ambulances, fire trucks, police cars, etc.) priority. Even before they reach the intersection, such cars require clever traffic signals to open the route for them.

Given the limitations of the conventional traffic management system, there exists a pressing demand to enhance its capabilities through the integration of intelligence for flexibility and adaptability. This advancement holds the potential to mitigate traffic congestion and bottlenecks, consequently leading to reduced travel times and lower environmental pollution. The original traffic management system was conceived several decades ago, catering to a significantly smaller volume of vehicles using the technology available at the time. With the exponential growth in vehicle numbers and the impracticality of expanding road infrastructure in many urban areas, innovative solutions are imperative, leveraging cutting-edge technologies to establish an intelligent traffic management system.

Hence, there is an imminent and compelling necessity to substitute the conventional traffic signal setup with an evolved framework: An Intelligent Traffic Management System (ITMS). This ITMS would offer a range of services unattainable by the conventional model, effectively addressing the aforementioned issues.

### *C. Research question*

What strategies and mechanisms can be implemented through an Intelligent Traffic Management System (ITMS) to effectively minimize traffic congestion and address associated challenges in Sri Lanka, considering factors such as traffic flow optimization, route prediction, accident prevention, and environmental impact?

## II. METHODOLOGY

This research aims to contribute to the understanding and advancement of Intelligent Traffic Management Systems (ITMS) by synthesizing insights from existing research articles. The methodology employed for this study involves a comprehensive literature review to gather relevant data, methodologies, and outcomes from prior studies. Reputable academic databases such as IEEE Xplore, ACM Digital Library, Research Gate, and Google Scholar were used to access a wide range of research articles related to ITMS. Relevant keywords, including "Intelligent Traffic Management System," "Traffic Control," "Smart Transportation," and related terms were used to conduct systematic searches. Selected articles were thoroughly reviewed to extract valuable data and insights. The relevant information, including ITMS technologies, algorithms, case study details, challenges, and outcomes, was systematically extracted from each article. The credibility of the extracted data was ensured by cross-referencing information from multiple reputable sources. Articles from well-established conferences and journals were given priority. The synthesized data from the reviewed articles were analyzed to identify trends, patterns, and gaps in the existing literature. The credibility of each article's findings was evaluated based on the reputation of the publishing venue, the author's expertise, and the rigor of the research methodology. It is important to note that the methodology relies solely on existing research articles up to the knowledge cut-off date. This approach may result in overlooking recent developments or specific nuances not covered in the reviewed articles. The proper citation and crediting of the original authors of the reviewed articles were maintained throughout the research process to uphold ethical research practices and intellectual property rights. To enhance the validity and reliability of this study, a systematic approach to data selection, extraction, and analysis was employed. This included cross-referencing information and prioritizing articles from reputable sources.

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### 1. The current traffic management system in Sri Lanka.

In the contemporary era, the Sri Lankan government employs a range of systems to address traffic-related challenges. These include the Advanced Traveler Information System (ATIS), Advanced Traffic Management System (ATMS), Advanced Public Transportation System (APTS), Emergency Management System (EMS), Transit Management Systems (TMS), Freight Management, and Incident Management Systems. The Advanced Traveler Information System (ATIS) incorporates diverse technologies like the Internet, telephones, cellular phones, television, and radio. This system is utilized by the traffic police department and traffic regulations consultants to effectively manage and regulate traffic conditions. It operates by monitoring traffic flow and promptly making well-informed decisions to ensure smooth traffic control. Advanced Traffic Management System (ATMS) refers to systems that facilitate vehicle movement through real-time information utilization. These systems are employed by traffic departments and law enforcement agencies to regulate traffic flow. The Advanced Public Transportation System (APTS) focuses on enhancing the operational efficiency of public transportation modes and boosting ridership by enhancing overall system reliability. Emergency Management System (EMS) is a field dedicated to managing risks and minimizing their impact. This system concentrates on addressing natural hazards that occur within the environment. These systems have been utilized thus far to manage traffic-related challenges.

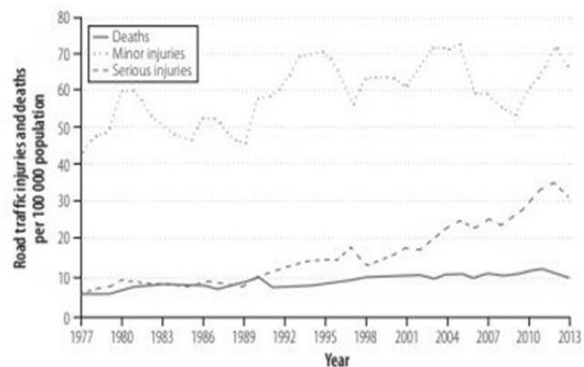
Utilizing existing information flows more effectively is a significant challenge that underlies discussions about the market value of information. An illustrative instance is the SCOOT (Split, Cycle, and Offset Optimization Technique) system, renowned as one of the world's most successful

adaptive traffic signal coordination systems. It optimizes signal timings across junctions within a network by leveraging comprehensive data and intricate calculations concerning traffic patterns in the area. Utilizing existing information flows more effectively is a significant challenge that underlies discussions about the market value of information. An illustrative instance is the SCOOT (Split, Cycle, and Offset Optimization Technique) system, renowned as one of the world's most successful adaptive traffic signal coordination systems. It optimizes signal timings across junctions within a network by leveraging comprehensive data and intricate calculations concerning traffic patterns in the area.

However, this valuable data resource remains underutilized, representing a pivotal aspect of the information value debate. A potential solution lies in extending access to traffic information providers. This proposition gains significance due to the widespread deployment of SCOOT systems, operational in over 130 locations across the UK, including cities, towns, and boroughs.

### III.SYSTEMATIC LITERATURE REVIEW

Figure 3. The period from 1977 to 2013 witnessed fatalities and injuries resulting from road traffic accidents in Sri Lanka.



Source: Road traffic crashes, injury and fatality trends in Sri Lanka: 1938–2013 by Samath D Dharmaratne, Achala Upendra Jayatilleke and Achini C Jayatilleke 25 June 2015

Road accidents pose a significant public health issue, with preventable injuries placing a heavy burden on healthcare systems. Globally, road accidents rank as the tenth most frequent cause of death. Statistical reports and census data reveal that road accidents were a prominent contributor to mortality in Sri Lanka in 2020. According to the latest data released by the World Health Organization (WHO) in 2018, road accidents accounted for 3,590 fatalities, representing 2.82% of total deaths in Sri Lanka. The age-adjusted mortality rate was recorded at 16.37 per 100,000

population, placing Sri Lanka 96th in global rankings. Notably, Sri Lanka boasts one of the lowest road mortality rates within the South Asian region. Road accidents and the resulting injuries and fatalities have reached epidemic proportions in Sri Lanka. In 2019, the number of reported fatalities due to road accidents was 2,839, while injuries amounted to 24,611. Notably, pedestrians accounted for nearly one-third of the total casualties, while motorcycles and tricycles were involved in over half of the incidents. Low-income commuters and drivers were disproportionately affected, comprising 70% of road accidents. Motorcycle-pedestrian accidents were particularly prevalent, contributing to approximately 40% of pedestrian deaths. Despite improvements in car safety, the specific needs of vulnerable road users have not been adequately addressed. Additionally, around 10% of the fatalities occurred at railroad crossings.

Road accidents lead to substantial economic consequences for individuals, families, and the entire nation. These repercussions encompass not only medical costs but also the loss of productivity from individuals who have succumbed to injuries or are undergoing treatment. Furthermore, families often need to take time off from their employment or education to provide care for the injured. The financial impact of road accidents typically amounts to approximately 3% of the national income in many countries (Dharmaratne, Jayatilleke, & Jayatilleke, 2015). The capital city of Colombo in Sri Lanka suffers a daily economic loss of approximately US\$5 million due to traffic congestion. Residents of Colombo and nearby areas express frustration and view the congestion as a significant hindrance to their daily lives. The government is also subjected to criticism for what is perceived as its failure to adequately tackle the problem. Analysts attribute the root problem to inadequate planning and the authorities' inability to enforce traffic regulations. A traffic specialist, contributing to a local e-paper known as *The Island*, emphasizes the importance of strategic timing and efficient utilization of traffic lights as a crucial element in resolving the congestion problem. The impact of traffic congestion is not limited to individuals alone, as it also incurs costs for the transportation industry. Carriers and fleet managers report increased vehicle wear and tear due to prolonged idling in traffic, with engines running for up to four to five hours per day. Another contributing factor to traffic jams is police corruption. Some officers accept bribes, allowing drivers to park their cars in prohibited areas, leading to further congestion issues. (Colombo Telegraph,2021)

The constant influx of people moving from rural regions to urban areas poses a significant challenge to road infrastructure and transportation systems, pushing them to their capacity limits. As a result, managing traffic has become increasingly difficult. The severity of the situation

is particularly notable in Asia, which is known for having some of the most congested traffic in the world. With the problem persistently escalating, city authorities are actively seeking effective solutions. Their exploration has led them to investigate a novel intelligent traffic management system that integrates artificial intelligence (AI) technology (Devanesan ,2020).

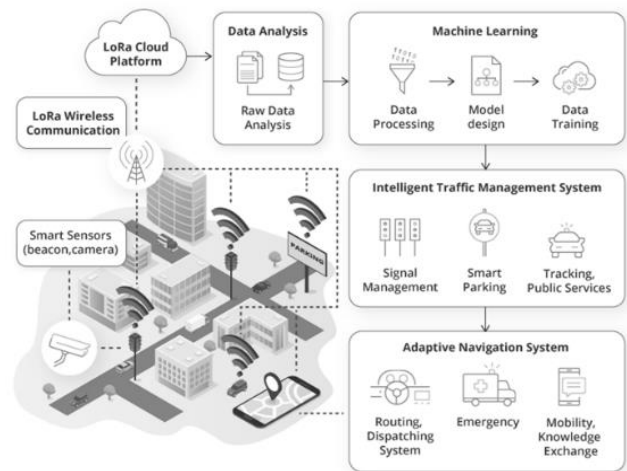


Figure 2.

Source: IEEE — The development of a Smart Town Traffic Management System that integrates LoRa and machine learning mechanisms

Intelligent traffic management systems are specifically developed to identify and monitor vehicles and pedestrians, as well as estimate safety indicators at intersections. The system incorporates object-tracking techniques to detect and track objects across successive frames, enabling the estimation of object trajectory and velocity. Additionally, the system has the capability to detect collisions and near misses. To provide a comprehensive overview, real-time dashboards are utilized to display extracted information from intersections alongside annotated video streams. The collected data plays a crucial role in fine-tuning traffic lights to optimize traffic flow at intersections and facilitate emergency service notifications. These notifications include essential information such as emergency response times, which are assessed and utilized to enhance intersection safety (Intel,2020).

Table 1. Main elements of an Intelligent Traffic Management System (ITMS)

Hardware	Software
IoT road sensors include:  RFID (radio frequency identification) or AIDC (automatic identification and data collection) tags  The Temperature sensors	Cloud computing and edge processing capabilities:  I. The Traffic data platform/data lake  II. Cloud-based traffic control systems  III. Geographic information systems (GIS)
Air quality sensors	All supporting transportation apps
Connected CCTV cameras	Big data and predictive analytics
Connected traffic light systems	AI/ML: A. Computer vision B. Optical character recognition (OCR) C. Reinforcement learning
Smart toll gates / electronic road pricing gantry systems	Location-based services

Source: pruzhytska (2022). Intelligent Traffic Management Systems: 6 Key Features to Implement. [online]

A. *The main capabilities of an Intelligent Traffic Management System (ITMS)*

I. The video traffic detection system with the edge processing function

The Intelligent Traffic Management System consists of various sub-modules, including the surveillance footage system, the traffic control system, the computer control system, and the peripheral unit. The traffic control units within the system are specifically designed to effectively manage and regulate high-traffic roads. There is a surveillance footage system that has cameras deployed to monitor traffic alerts and traffic controllers to take action to prevent traffic congestion when the number of cars in a certain area grows. Traffic control units play a main role in the efficient management of traffic by facilitating seamless communication between senders and receivers. Peripheral units, on the other hand, handle sensor configuration, process the gathered data, recognize signals, and transmit responses to the control unit. The control unit itself is responsible for detecting traffic flow and establishing communication with other peripheral units (AumRaj,

2022). The elements of a modern Traffic management System consist of:

1. Connected CCTV camera with HD recording
2. The computer vision function for image detection and recognition
3. The edge chip for local video processing, reduced latency
4. Cloud connection + GPS-based communication to receive updates.
5. These settings allow you to:
  - I. Detect incidents that will occur – car accidents, obstacles, illegal parking, inadvertent cyclists or pedestrians
  - II. Send alerts to intelligent traffic management systems in seconds.
  - III. Create or automate a series of subsequent tasks to be performed automatically.
    - A. Dispatch emergency services,
    - B. Signals in traffic customization areas
    - C. Control, reroute public transport, and provide information to nearby drivers.

Data analysis and the utilization of intelligent systems are employed to effectively manage congestion scenarios and implement control measures (Arai, K., Kapoor, S. and Bhatia, R.,2020). Technological advancements integrated within or near roads have a significant impact on enhancing the safety of drivers, passengers, and pedestrians. Through the utilization of sensors and cameras installed on roads, traffic lights, and strategic locations, real-time data regarding vehicles, driving conditions, and potential risks can be collected and transmitted. These technologies work in synergy to create more intelligent and secure road environments (Pagano,2016). For instance, the intersection collision avoidance system employs sensors to monitor traffic as it approaches hazardous intersections, promptly notifying vehicles through roadside signs. Given that intersection collisions contribute to approximately one-third of all accidents in the United States, field tests have demonstrated the effectiveness of such systems in reducing both the speed of oncoming vehicles and the occurrence of collisions at perilous junctions. Another example is the Dynamic Curve Warning System, which employs radar to measure the velocity of vehicles approaching curves. Electronic signs then display the safe speed at which the curve can be navigated, taking into account real-world conditions, subsequently facilitating a reduction in speed (A, Vidya, and Kaviyarasi, 2018). The Wildlife Detection System employs various detection methods, such as infrared technology, to identify the presence of large animals nearing the road. Once an animal is detected, a blinking sign is triggered to alert the driver (Zhang et al., 2023). These systems hold particular significance in rural regions, where the occurrence of

animal-related fatalities is nearly five times higher compared to urban areas.

Road weather sensors offer up-to-date data on hazardous conditions like frozen bridges, water on roads, upcoming rainfall, and fog. This information can be communicated to travelers through dynamic signs, highway advisory radios, and vehicle navigation systems (Mary G et al., 2022). One of the significant advantages of implementing edge data processing capabilities, coupled with live video, is the opportunity to leverage the collected data for various intelligent traffic analysis applications.

- Multimodal traffic volume analysis aims to understand the most commonly used transportation modes in the region and their average travel speeds.
- Traffic safety analysis utilizes pattern recognition to identify improper behavior of drivers and pedestrians in different areas, allowing for appropriate actions to be flagged.
- The response unit program generates alerts for police, ambulances, and maintenance crews after detecting an incident.
- Traffic analysis of origins and destinations facilitates the creation of improved traffic management plans and enables control updates for frequently traveled routes.

## II. Pedestrian Detection and pollution analysis

The continuous collection and processing of real-time traffic data play a vital role in enhancing the efficiency and safety of pedestrian traffic. By analyzing the current presence of pedestrians and vehicles on the road, it becomes possible to improve the management of pedestrian flows and ensure their safety. Intelligent Traffic Management Systems offer three important capabilities: locating and mapping the system's applications, establishing connectivity with the external environment, and utilizing satellite navigation systems such as GPS to determine the precise location and velocity of objects at any given time (Šimunović, Bošnjak and Mandžuka, 2012).

Data regarding the location of pedestrians or vehicles can also be obtained through various means such as sensors installed in vehicles, on roadways, and even on pedestrian equipment. As an illustration, in Japan, tracking tags are incorporated into school backpacks, enabling parents to keep track of their children's whereabouts. In the context of safety, women in England who traverse hazardous urban areas utilize location-tracking devices discreetly embedded in their rings. These examples highlight the diverse applications and methods employed to collect location data for different purposes. The GPS device utilizes satellite data to approximate the location of the vehicle or

pedestrian within a range of 3 to 6 meters (10 to 20 feet). (Šimunović, Bošnjak and Mandžuka, 2012).

The data collected is transmitted to the central system through either the Internet or the smartphone network. Valuable information for pedestrians, such as predicted vehicle movements and scheduled arrival times of public transportation, can be displayed using information displays. This is particularly beneficial for pedestrians waiting at bus stops. Additionally, voice announcements can be provided, which is especially helpful for individuals with visual impairments. To enhance pedestrian safety, both vehicles and roads are equipped with various systems. These systems enable drivers to detect and avoid collisions with pedestrians, thus improving overall traffic safety. For instance, sensors can be installed at crosswalks to alert drivers when pedestrians are crossing the road, ultimately reducing the number of pedestrian fatalities at such locations. Automobile emissions are a major contributor to the high levels of air pollutants, which have a significant negative impact on human health. Additionally, it aggravates cardiovascular issues and caused avoidable ailments, including respiratory disorders like asthma. The World Health Organization (WHO) reports that approximately seven million premature deaths occur annually due to air pollution, and numerous cities worldwide exceed recommended air quality standards. Air pollutants are categorized into primary and secondary pollutants (Zhang et al., 2022).

Primary air pollutants encompass a range of substances such as nitrogen oxides (NO<sub>x</sub>), sulfur oxides (SO<sub>x</sub>), ammonia (NH<sub>3</sub>), carbon monoxide (CO), benzopyrene (BaP), methane (CH<sub>4</sub>), and these pollutants are directly emitted into the atmosphere and contribute to air pollution (European Environment Agency, 2019). Ozone (O<sub>3</sub>) and nitrogen dioxide (NO<sub>2</sub>) are examples of secondary air pollutants. In urban areas, air pollution is a significant concern, largely driven by motor vehicle emissions. Maintaining acceptable air quality is a pressing issue for many cities. The Intelligent Traffic Management System plays a crucial role in addressing this problem by implementing various emissions, models and utilizing databases of emission factors. Efficient management of traffic flow can have a positive impact on reducing pollution. By optimizing traffic patterns and reducing congestion, individuals can save fuel, which in turn contributes to lower levels of pollution (AumRaj, 2022). The Intelligent Traffic Management System has the capability to predict and anticipate instances of air pollution by analyzing specific conditions at certain locations, providing forecasts up to an hour in advance. In response, the system adjusts traffic signals accordingly, creating a slight delay for vehicles heading toward pollution-prone areas while allowing smoother traffic flow

and longer green lights for vehicles moving away from these areas. Each intersection makes independent judgments and communicates with the wider traffic light network to enhance the efficiency of vehicle movement, reducing time wasted at traffic junctions and improving overall traffic flow. Based on pilot testing conducted in Pittsburgh, the implementation of an Intelligent Traffic Management System in a city has demonstrated the potential to reduce travel times by up to 25% and decrease harmful emissions by up to 21% (Khanna et al., 2018).

According to a researcher from the University of Malaga in Spain, having a comprehensive understanding of the city and analyzing each vehicle, pedestrian, and bus is crucial for enhancing mobility and reducing emissions. This approach allows for the creation of an accurate map of the city and its traffic signals. By leveraging historical data and anticipating future changes, the computer can adjust traffic signaling to optimize traffic flow. Intelligent traffic control systems go beyond simply timing green lights; they also contribute to the development of cleaner and safer urban environments. These solutions provide real-time impact data, helping city planners accelerate their efforts to achieve zero-carbon transportation goals (Toutouh and Alba, 2022).

Such as:

- A. *Air pollution levels and air quality in the area*
- B. Carbon dioxide (CO<sub>2</sub>) emissions for each individual trip
- C. Traffic volume and average speeds during different weather conditions
- D. Impact on road infrastructure following natural disasters like hurricanes and floods
- E. Analysis of unsafe driving behaviors, such as sudden braking or rapid acceleration.

Ultimately, the successful implementation of efficient and sustainable traffic management systems relies on the ability to collect and analyze significant traffic data using advanced analytics.

While this task may present technical challenges, it is achievable with the right approach and resources.

### III. FINDINGS

By implementing an Intelligent Traffic Management system, countries have the potential to address numerous challenges associated with road traffic, including reducing human fatalities, alleviating road congestion, and mitigating environmental pollution, as indicated by the findings of the literature review. Sri Lanka, being a developing country, can leverage this concept to its advantage. With the right tools and a skilled workforce, Sri Lanka has the opportunity to unlock significant benefits from adopting an Intelligent Traffic Management System. In addition to the aforementioned advantages, it is important to highlight some additional key points. Firstly,

an Intelligent Traffic Management System can enhance the overall efficiency of transportation networks by optimizing traffic flow, reducing travel times, and minimizing fuel consumption. This can result in cost savings for individuals and businesses, boosting economic productivity. Furthermore, the system can contribute to improved road safety through the implementation of various safety measures such as collision detection, pedestrian monitoring, and intelligent signaling. By effectively identifying and addressing unsafe driving behaviours, the system can help prevent accidents and save lives.

Moreover, the integration of real-time data analytics and predictive modeling capabilities can enable proactive decision-making and enable authorities to respond swiftly to changing traffic conditions, incidents, and emergencies. This can lead to more effective emergency response times, reduced traffic disruptions, and enhance overall management of the transportation infrastructure.

Additionally, it is worth mentioning that the adoption of an Intelligent Traffic Management System can position Sri Lanka as a progressive and technologically advanced country in the transportation sector. This can attract investments, promote sustainable urban development, and contribute to the overall modernization of the country's infrastructure.

In conclusion, the findings suggest that Sri Lanka has the potential to derive significant advantages from implementing an Intelligent Traffic Management System. However, it is crucial to emphasize the importance of proper planning, investment in technological infrastructure, and the training of skilled professionals to ensure the successful deployment and operation of such a system.

### IV. CONCLUSION

The Intelligent Traffic Management System (ITMS) emerges as a valuable innovation that addresses the limitations of existing traffic management systems and their associated web structures. The extensive data collection facilitated by ITMS enables improved forecasting and management of traffic issues. However, the successful implementation of ITMS requires more than just technological advancements. It necessitates strong policy frameworks, effective laws and regulations, appropriate sector coordination, and collaborative efforts.

Leading countries in technology and transportation, such as the USA, Japan, Russia, Korea, and China, have embraced ITMS with remarkable success. These countries serve as exemplary models for other nations aspiring to enhance their traffic management capabilities. Additionally, researchers continue to delve deeper into this concept,



striving to advance ITMS algorithms and expand their capabilities further.

The benefits of ITMS are diverse and impactful. One notable advantage is the reduction of traffic congestion, which not only improves the efficiency of transportation networks but also enhances the overall quality of life for citizens. By implementing intelligent algorithms and the real-time monitoring, traffic flow can be optimized, reducing travel times and minimizing delays.

Another crucial aspect of ITMS is its potential to address environmental concerns associated with automobile emissions. Through efficient traffic management and control, ITMS can help reduce air pollution and minimize the carbon footprint of transportation systems. This contributes to a cleaner and more sustainable urban environment. The integration of road sensors and advanced detection systems enables ITMS to detect and respond to pedestrian presence, enhancing overall road safety. By implementing measures such as pedestrian detection, intelligent signaling, and collision avoidance systems, the risk of accidents and injuries can be significantly reduced. It holds significant importance to note that the success of a smart and developed city relies not solely on a single technology, but on a comprehensive approach. While ITMS plays a significant role, other technologies and strategies, such as smart infrastructure, efficient public transportation, and sustainable urban planning, are equally vital for creating thriving and liveable cities.

Ultimately, the success of ITMS and the achievement of its full potential depend on human intellect and collaborative efforts. The continuous development and refinement of this concept, combined with visionary policies, investments in research and development, and the active participation of stakeholders, will pave the way for smarter and more efficient urban environments.

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I am currently enrolled in the General Sir John Kotelawala Defence University's 39th Intake, where I am pursuing a Bachelor of Science in Applied Data Science and Communication. I am particularly interested in data science and artificial intelligence because of the potential for these fields to completely change a variety of sectors. Specifically, I am interested in exploring the applications of these fields in intelligent traffic management systems and their impact on improving urban environments. Through my studies and research, I aim to contribute to the advancements in data science and AI while developing innovative solutions for real-world challenges.

# Evolving Towards the Future: Internet of Things (IoT)-Based Precision Aquaculture System

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**Abstract**— *Humans and technology have been developing continuously from the prehistoric period to the present and it has evolved into a key component for assisting with daily tasks in today's world of technology. As an approach to fulfilling nutritional needs and a variety of other necessities, civilizations established agriculture millennia ago.*

*Aquaculture is yet another important concept in agriculture, where farmers cultivate fish in ponds and tanks for human consumption. Aquaculture, or fish farming, has long been recognized for its significance by agriculture, which has its roots in satisfying human needs and it is only one of the many industries that are undergoing advancements driven by modern technologies. As technology continues to evolve, IoT-based aquaculture systems are gradually replacing traditional fish farming techniques. By applying Internet of Things (IoT) and AI-based technologies, the system enables fish farmers to accurately monitor the growth and wellbeing of fish as well as the water quality, temperature, and pH levels in fish tanks. This system, which is readily accessible through computers, tablets, and mobile phones, minimizes manual labor while significantly expanding aquaculture outcomes, resulting in advantages for the fishery's marketing industry.*

*The primary objective of this research project is to explore through the prospective benefits associated with implementing IoT and AI technologies in aquaculture and further this study explores artificial intelligence utilization in aquaculture worldwide, focusing on analytical models, AI-powered image recognition and vision-based algorithms for disease management and sustainable methods to improve awareness of the role that technology plays in strengthening efficiency and ensuring long-term sustainability for the aquaculture sector by examining certain scenarios and possible benefits.*

**Keywords**— **Aquaculture, IoT and AI technology, Remote access, Solar power, multi-sensor**

## I. INTRODUCTION

Aquaculture refers to the raising and harvesting process of aquatic organisms, and it is rapidly developing into a significant aspect of modern-day agriculture. It involves cultivating numerous species for human consumption while also preserving the health of the aquatic environment. These organisms include seaweed, shrimp, cockles, crawfish, mussels, and crabs, among many more. As the worldwide population keeps on expanding, the requirement for food has grown to previously unimaginable stages, expanding and resulting in cutting-edge approaches to meet the rising needs.

Seafood is essential in human diets because it provides significant proteins, minerals, and nutrients necessary for a healthy lifestyle. Given an overall initial sales worth USD 401 billion, fisheries output worldwide in 2018 surpassed 179 million tons. Aquaculture output accounted for 82 million tons with a value of USD 250 billion. Twenty-two million tons were utilized for non-food items including the manufacturing of fishmeal and oil, leaving 156 million tons for human use. Aquaculture provided 46% of total production, with 52% intended for consumption by mankind. China remains to be the largest seafood supplier in 2018, accounting for 35% of global fish productivity. (Food and Agriculture Organization of the United Nations, 2020) As a result of an increasing need on seafood, fish farmers across the globe are embracing the challenge of continuing this required sector. To satisfy the rising demand, they are actively implementing efforts toward increasing production and efficiency.

Over the last five decades or so, aquaculture has benefited greatly from technological developments, which have allowed for higher productivity and sustainability. (Food and Agriculture Organization of the United Nations, 2020) The Internet of Things has significantly benefited aquaculture since it has allowed producers to utilize technology to their own gain throughout the whole production cycle. The aquatic industry could undergo an

extensive shift as a result of the combination between IoT and AI technology. This interaction has the potential to result in more effective resource usage, lower environmental impact, and greater welfare for the fish. IoT's real-time monitoring improves the reliability of AI models, resulting in enhanced decision-making and sustainable development.

The use of these technologies throughout a variety of industries comes with positive and bad effects. There is no denying that technologies including AI and IoT maximize productivity.

The scope of this research is to investigate the minimal adoption of IoT and AI technologies in Sri Lankan aquaculture and to assess their significant advantages and prospects. It highlights the hurdles and constraints preventing overall adoption whilst highlighting the significance of utilizing advanced technologies to efficient use of resources, sustainable growth, and living standards. However, there are also different challenges that need to be considered. Preservation of data and data encryption are of the highest priority due to the possibility for problems that might be exposed by greater interconnection as well as information interchange. Another barrier is the overall cost of installing IoT and AI devices, which involves infrastructure and technology breakthroughs. Yet, because of their benefits, such as higher output, resource efficiency, and precise decision-making, both AI and the Internet of Things are prospective technologies for strengthening precision the aquaculture industry and agricultural sustainability.

## II. RELATED WORK

Agriculture has been transformed by IoT and AI technology, which resulted in more environmentally friendly approaches. Real-time data collection and analysis on environmental elements, agricultural production, and soil conditions is carried out via IoT equipment such sensors, controllers, and drones. These advancements have revolutionized traditional agriculture while also benefiting aquaculture.

Sri Lanka, an island nation in the Indian Ocean that is tropical and comprises 65,610 km<sup>2</sup>, has a robust fishing sector that contributes a substantial contribution to the country's economic growth. The local economy of coastal communities is nourished by fishing, which is a widespread vocation. Seasonal village ponds and tanks are the primary source of Sri Lankan inland aquaculture. Ornamental fish from the country's freshwater and brackish water ecosystems are in high demand overseas; significant gainers include France, Germany, the United States, the United Kingdom, Belgium, Japan, Spain, the Netherlands, and New Zealand. Popular ornamental fish species

including the swordtail platy, molly, angels, goldfish, and zebra dominate the export market, accounting for around 60% of all fish exports. Moreover, widespread indigenous tilapia fish is a rich resource for both domestic consumption and potential export. (The World Bank Group, 2022).

The method by which data is gathered, processed, and applied in the aquaculture sector has been transformed by the combination of machine learning algorithms and data analysis methods with IoT devices. IoT sensors and devices provide enormous volumes of data, which ML algorithms may analyse to find relationships, trends, and patterns that may be applied to improve aquaculture operations. Aquaculture operators may enhance overall farm management techniques, optimize feed formulas, expect ideal harvesting periods, and acquire a deeper knowledge of the factors impacting fish health by utilizing ML and data analysis. These cutting-edge innovations hold an opportunity to reduce hazards and promote sustainable aquaculture practices, creating up prospects for a more productive and sustainable field. (Chiu et al., 2022)

However, the aquaculture sector encounters difficulties in managing water quality, tracking resources, and monitoring temperature increases, all of which have a significant influence on the overall well-being of aquatic life. Traditional methods of managing these resources are often lacking resulting in higher rates of fish loss and reduced productivity.

The PROTEUS project focuses on affordable cost, multiple capacities, adaptability with diverse technological procedures, and sensitivity with the objective to improve water monitoring technologies. Along with positive outcomes from biological pollution experiments and decreased sound features, its ability to monitoring the pH level, chlorine, and chlorides, nitrites and calcium in difficult conditions is explored. The project assures a low-cost, highly multiplexable multiparameter sensor device for live measurements with the possibility for increased sensitivity through use of transistor techniques. The project's influence on the real-world practice of monitoring the quality of water is emphasized, with a primary focus on practical, accurate, and sustainable solutions. The initiative has had a major and long-lasting effect on aquatic environmental monitoring. (Dupont, Cousin and Dupont, 2018).

According to the study, 'An Integrated Wireless Multi-Sensor System for Monitoring the Water Quality of Aquaculture' it demonstrates an overall structure for evaluating fish farm water quality utilizing a variety of sensors and tools. For temperature monitoring, the system has a pH Sensor, a Digital EC Meter, and a Resistant Sensor. Processing and data transport are handled by the Arduino UNO microcontroller and Raspberry Pi 3 CPU.

Guidelines for activities are given on a PHP website based on the water quality. For a thorough examination of the water quality, precise sensor readings are essential. (Lin, Tsai, and Lu, 2021)

In order to establish a healthy environment for the development of plants and fish, the paper on 'Comprehensive Review of Aquaponic, Hydroponic, and Recirculating Aquaculture Systems' suggests a method where aquaponics integrates hydroponics with aquaculture. A soilless technique called hydroponics has benefits including quick plant development and maximizing elements like distance, efficiency, and quality of production. To monitor and manage the aquaponics system, the suggested system makes use of hardware elements and Internet of Things technologies. The suggested method intends to produce consistent plant growth rates, efficient production, and reduced water usage. Aquaponics demonstrated faster plant growth rates than conventional techniques for a variety of plants, including spinach, yard beans, French beans, red beans, and bitter guard. Through a mobile application, the system's interaction with the user enables surveillance and management. (Rajalakshmi, Manoj and Manoj, 2022)

Yet another study discovered an approach to recognize and maintain the ideal environment of a freshwater shrimp farm within control. To monitor and regulate important parameters, it utilizes a wide range of detectors and an automated monitoring system. The system consists of an electrical conductivity meter to measure salinity, a Temperature Sensor, a salinity sensor to evaluate aquatic environment, a pH sensor to assess pH levels, an oxygen concentration sensor, a light exposure sensor to control shrimp behaviours, and a dissolved oxygen sensor. Data is gathered and handled using Arduino software, and the hardware resources are linked to an Arduino board. The information is then sent to a Mobile application, which offers a simple user interface for keeping track of the shrimp farm, showing real-time statistics, and providing management. (Uddin et al., 2020)

#### *A. Global aquaculture methods*

IoT utilization in aquaculture has undergone an upsurge in demand over the past several years on a worldwide scale. The potential advantages of IoT in enhancing both the efficiency and the long-term viability of a country's aquaculture systems have been acknowledged by several nations across the world. The adoption of IoT in fisheries has accelerated throughout both industrialized and developing nations. These economies have recognized how analysis of data, and automation possibilities offered by IoT could impact the method by which aquaculture operates forward. Aquaculture analysts may collect

accurate information on water quality, surrounding circumstances, and fish by using IoT devices. These technologies are being used in aquaculture and in several minor business operations as well.

IoT technology is also adopted by cooperatives and small-scale fish farmers throughout the world to increase production and profitability. These farmers could overcome obstacles like limited resources, rapidly changing climatic conditions, and market access by utilizing IoT solutions customized to their needs. They can remotely track and control their farms using IoT-enabled technologies, get timely notifications, and decide on smart choices to increase harvests.

Norway has been in the leading edge of using IoT in aquaculture and is among the global leaders in salmon farming. To gather real-time information on water quality, fish activity, eating habits, and health indices, they have set in place complex monitoring systems that utilize the use of sensors and underwater cameras. (Skjæran, 2022).

Aquacultures have a long history in Japan, which adopted IoT to advance the sector.

They apply IoT devices like sensors, drones, and self-driving underwater vehicles namely AUVs to observe fish movements, check water quality, and supervise feeding operations.

Japanese aquaculture professionals can maximize feeding schedules, regulate water quality better, and lower the danger of diseases with the use of IoT technologies.

(FutureIoT Editors, 2022)

Chile has been using internet of things in aquaculture and is one of the key players in the cultivation of salmon field. They use IoT technologies to maintain tabs on fish farm characteristics including pH, salinity, temperature, and oxygen levels. IoT solutions for Chilean aquaculture aid farmers in preserving ideal water conditions, guaranteeing fish wellbeing, and stopping disease outbreaks. (Hanchett, 2020).

Singapore has employed advanced techniques, which include IoT, for the cultivation of aquaculture despite being a small country with few opportunities for traditional aquaculture. They are setting in place urban aquaponics systems which combine hydroponic plant culture with fish husbandry. IoT technology is employed in Singapore's urban aquaculture industry to track and manage variables including water quality, fertilizer levels, and temperature. (Mok, Tan and Chen, 2020)

The Yield is an Australian company founded in 2014 focused on developing the Sensing Aqua Internet of Things (IoT) platform for the benefit of the oyster industry. The technology uses sensors to collect information about the climate, including salinity, water temperature, depth, pressure readings and tide levels. The Microsoft-powered Yield cloud platform receives this data, processes it using

artificial intelligence and advanced analytics algorithms, and produces three-day forecasts of local weather and best harvest times. For oyster farmers, who often suffer financial losses from heavy rains, The Yield's hyperlocal layouts are particularly useful. According to the predictive IoT system, harvest downtime will be reduced by 30%, bringing significant financial benefit to oyster farmers. Yield's advanced IoT prediction technology can even give a delicious coating to oysters. Further an Indonesian firm named 'Jala' focuses on IoT hardware and software to monitor the water quality in shrimp farms. Their complete equipment measures and reports oxygen levels, humidity, temperature, the pH level, salinity levels, and overall solids dissolved through web or smartphone interfaces.

'Eruvaka Technologies', which was launched in 2012, provides surveillance methods for fish farms, including their solar generated 'Pond Guard' system. These sensors enable real-time monitoring of critical water parameters, allowing for preventive problems detection and up to 20% energy cost reductions.

'Sensaway, a Portuguese aquatic establishment, manufactures solar-powered sensors that are easier to maintain and operate than existing market versions. (Nanalyze, 2018)

These instances show how several nations have adopted IoT aquaculture technology to increase productivity, sustainability, and profitability. They seek to improve production methods, reduce environmental effects, and guarantee the welfare of aquatic species by utilizing real-time data and smart monitoring systems. The technological environment of a nation is influenced by factors like supplies, infrastructure, and financial conditions.

For instance, Sri Lanka, as a third world nation adopting hydroponics technology can significantly contribute to economic progress and transform traditional living methods. This technology increases food production capacity, reduces import reliance, and promotes self-sufficiency. By expanding and upgrading the agricultural sector, Sri Lanka can boost its economy, food safety, and sustainable development.

### III. METHODOLOGY

The decision to focus on specific sensors to satisfy the needs of the industry was made after a thorough evaluation of multiple publications and websites focusing on Internet of Things, or IoT, technologies in aquaculture.

Elements that affect water quality must be effectively monitored in aquaculture systems to guarantee the overall well-being of aquatic organisms. There are several sensors utilized, which includes conductivity, ammonia, turbidity, chlorophyll, oxidation, and reduction potential (ORP), total

dissolved solids (TDS), carbon dioxide (CO<sub>2</sub>) and Phosphate levels. These sensors are linked to provide a thorough monitoring system which allows to maintain the ideal water quality parameters necessary for aquatic life to become successful. They were discovered to be the most suitable choices for obtaining current data and monitoring critical aquaculture system features. (Zhuiykov, 2012)

#### A. Monitoring Water Quality through Sensors

Since water is a crucial component of the survival of fish as well as other aquatic species, effective water quality monitoring is essential in aquaculture. The poor condition of the water is the most common issue faced when aquaculture results is unsuccessful. As a result, water quality monitoring is essential throughout operations. When it comes to providing their aquatic species with the best possible water conditions, fish farmers must overcome a number of obstacles. The implementation of IoT-based technologies in aquaculture, however, offers an acceptable way to overcome the difficulties and obtain plenty of advantages, Fish are raised through a variety of methods including aquatic, brackish and also saltwater ecosystems. Raising fish and aquatic animals in saltwater or marine environments is referred to as mariculture. (Food and Agriculture Organization of the United Nations, 2020) Despite of the aquaculture technique used, aquatic life's health, development, and production is greatly influenced by the water quality.

Since slight modification can have a negative impact on the fish population, maintaining ideal conditions for the water continuously can be quite difficult for fish farms. Consequently, it is crucial to incorporate advanced monitoring systems that use sensors. Fish farmers can improve overall output by effectively managing possible problems by regularly monitoring water quality measures. As an example, the application of the sensor platform from 'Libelium' is connected to IoT monitoring system. This platform incorporates innovative devices, such 'The Wasp Mote Plug & Sense! Nodes', that are made especially for checking the water quality in aquaculture. These nodes, which may be properly placed in fish farm ponds and include systems such 'Smart Water and Smart Water Ions', can encompass broad areas and offer thorough data. The system of sensors allows for live measurements of such essential water quality indicators as humidity, dissolved oxygen, pH levels, the compound ammonium and nitrogen levels. To store, analyse, and visualize this information, it is wirelessly delivered to an entry point, which links to a cloud-based platform. Using a dashboard that is easy to use on their tablets, PCs, or cell phones, fish farmers may access this data, enabling them to keep track of the water levels remotely and come up with wise decisions. (Libelium, 2018).

Effective control of water quality is essential for aquaculture, especially in countries with limited resources such as Sri Lanka where accessibility to power in rural regions may be constrained. This problem may be effectively solved through an installation of water quality monitoring even in remote areas by integrating a solar-powered sensors in IoT-based monitoring equipment. For this approach, a structure of a circuit that includes key parts like as sensors, microcontrollers, solar panels, batteries, and communication units needs to be applied. For the firmware process, a microcontroller should be set up to gather data, monitor its energy usage efficiently, and also to easily communicate the data to a selected web server or a platform which is programmed to transfer data simply towards a cloud-based system or database system. It has a lot of effectiveness and offers many benefits in a variety of applications to design a renewable sensor device for monitoring the condition of water. To optimize the advantages of solar power, these sensors must be environmentally friendly and suitable for low-power operation. A solar panel is also necessary for the system to take in sunlight and turn it into electricity for the sensors as well as other electrical parts. To store extra energy produced during bright hours for use during dark or nighttime circumstances, which involves a rechargeable battery, remains necessary. A form of communication component, such Wi-Fi or cellular connection, can be included to facilitate wireless data transmission. Finally, real-time data should be presented in a user-friendly interface or dashboard so that individuals may easily access and analyse it. An effective sensor system driven by solar energy may be built to monitor water quality, offering a cost-effective and sustainable option for the aquaculture industry. Operating expenses for standard monitoring systems powered by electricity will be decreased by solar energy.

Farmers in Sri Lanka could lower maintenance costs and power bills by utilizing the country's warm weather, which lowers the cost and accessibility of water quality monitoring sensors powered by solar may simply be adjusted up or down depending on the demands of various aquaculture systems. The adaptability of solar-powered sensors enables deployments depending on the scope and needs of the farm, whether it is a smaller fishpond or a bigger aquaculture plant. The deployment of IoT-based tracking devices is also consistent with Sri Lanka's objectives to modernize and improve its farming industry via the adoption of cutting-edge technologies. It fosters the financial well-being of rural communities that engage in fish farming, encourages a long-term development of aquaculture, and increases productivity.

#### *B. A sensor for monitoring aquatic species development and well-being*

It is essential to regularly monitor the development, well-being, and behaviours of aquatic life in aquaculture systems in addition to the water quality. In the past, fish farmers were dependent on manual methods of evaluation to determine the health and wellbeing of the aquatic organisms, which frequently led to handling of the fish, disruption of the aquatic environment, and even mortality.

Fish farmers may now simply and rapidly monitor the biological as well as developmental aspects of the fish by deploying wireless sensors created particularly for fish monitoring. These sensors can also notice changes in background, making it simpler to recognize and handle any difficulties. The habits, consumption patterns, and biological traits can be monitored through collecting data. Any unusual behaviours, food preferences or stress cause can be quickly identified, and corrective measures can be performed by continually monitoring the aquatic organism's health and physiological responses, the sensor-based system for monitoring offers immediate data on fish eating habits, behaviour, and biological traits. This data is crucial for comprehending the organism's overall performance, Farmers can customize feed utilize, avoid excessive feeding as well as underfeeding, and make sure the nutritional needs of the fish are satisfied by getting knowledge into the behaviour of the fish.

Furthermore, risk reduction and climate adaptation depend heavily on these sensors' capacity to recognize environmental changes.

Aquaculture operations can predict and adapt to changes in the water's conditions by maintaining a close eye on variables like humidity and levels of oxygen. In addition to reducing discomfort on the fish and fostering a more stable and beneficial environment for their growth, this enables greater supervision over the farming settings. One of the main benefits of this sensor-based technique is that it causes the least amount of disturbance to aquatic life and does not require having access to the ponds or fish tanks for evaluation. In order to provide a non-intrusive monitoring option, the sensor serves as a waterproof camera that is placed above the water's surface. The required indications and insights into the development and health of the fish are then extracted from the acquired data utilizing automated analysis performed by specialized algorithms. By establishing an alarm system which provides real-time notifications to fish the controllers whenever unexpected behaviours, health concerns, or environmental changes are noticed.

#### IV. THE POSSIBLE ADVANTAGES OF IOT AND AI IN AQUACULTURE

By shifting from outdated and unsustainable fishing techniques to more modern ones, Sri Lanka, as an emerging economy, could speed up its economic



development. The country could experience a variety of benefits and open new development potential by implementing cutting-edge technology and methods in the fisheries industry. The nation's economy can be more diversified and less dependent on traditional industries by making investments in the latest innovations like IoT in aquaculture.

Increased opportunities for entrepreneurship, employment growth, and economic development may result through this. The practical use of innovative technologies, such as IoT, in aquaculture could attract investment from abroad since it displays the nation's dedication to technological innovation and sustainable growth. Growth in the economy could be sped up by higher foreign direct investment by introducing fresh investment capital.

Exporting fisheries products from Sri Lanka to foreign markets also has tremendous possibility. The nation may improve the quality of products, transparency, and sustainability by implementing IoT in aquaculture, boosting its ability to compete in the global marketplace and producing foreign exchange revenues.

Poverty Reduction and Rural Empowerment; Aquaculture holds an opportunity to be adopted in Sri Lanka's rural regions, especially when combined with IoT technology. Particularly in coastal and rural populations that primarily rely on standard fishing techniques, this can generate employment opportunities, improve livelihoods, and lessen poverty.

Strengthening Industrial Sustainability and Efficiency; Aquaculture systems built on the Internet of Things allow for accurate surveillance, technology, and decision-making based on data. This might result in higher production, lower costs, and better resource management, thus improving the aquaculture industry's overall effectiveness. The development of IoT-based aquaculture necessitates a staff with advanced technological and data analytics skills. Sri Lanka may establish a pool of qualified individuals capable of encouraging innovation and technical breakthroughs in the fishery industry by launching programs of training and educational opportunities.

#### V. FUTURE WORK

There is an increased likelihood toward employing an exact sensor in the setting of future work in order to advance the current study. Although the findings and conceptual frameworks applied in this study were previously accessible, using an actual sensor would provide an opportunity to collect data directly and evaluate their findings. The addition of a real sensor supplies an enormous opportunity for overcoming the gap between theories and concrete evidence.

#### VI. CONCLUSION

The primary goal of this study is demonstrating the possible advantages of IoT and AI technologies which could potentially be implemented in Sri Lanka. Sri Lanka, an island nation with a rich agricultural heritage, has the opportunity to leverage its aquatic resources and develop from the oceans. By embracing aquaculture as a means of economic prosperity, Sri Lanka can break free from traditional agriculture constraints and address pressing issues like malnutrition, particularly among children. By starting at the grassroots level, Sri Lanka can lay the foundation for a brighter future, harnessing the vast potential of its aquatic resources to improve financial prospects and well-being. Although Sri Lanka utilizes IoT and AI technologies sparingly, it offers enormous potential to advance several industries.

Sri Lanka can increase effectiveness, productivity, and breakthroughs in agriculture, industry, healthcare, transportation, and other sectors by implementing these technologies. Adoption of these technologies can result in better resource management, better decision-making, additional interaction, and a better standard of living for citizens. Recognizing and enhancing infrastructures skills, and regulatory systems is critical for Sri Lanka to maximize its potential.

The paper points out the value of choosing appropriate sensors for setting up in Sri Lanka's setting while acknowledging instances of other nations wherein these advances have been effectively adopted. It's crucial to remain aware that this study has certain boundaries.

IoT and AI are generally discussed in terms of the benefits they offer; as a result, not all of the possible drawbacks or difficulties that arise from their adoption could be addressed.

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# Portfolios as a Student-Assessment Tool: A Study Based on HNDE Students at Advanced Technological Institute, Anuradhapura

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**Abstract**— *The current research was conducted to measure the impacts of the Portfolio Assessment on HNDE learners in using it as a continuous assessment method for the module, Language Structure Usage and Linguistics. The sample group included 120 HNDE students from the 1<sup>st</sup> year batch. This research involved planning and implementation of the portfolio assessment and collecting feedback from the participants. Data collected indicated that the HNDE followers are assessed through different assessment methods. As far as the experiences of the participants are concerned, this is a great assessment method since it helps them in many ways: memorization, exam preparation, displaying creativity, developing organizing skills and expanding their knowledge. As the evaluating experience revealed, the lecturer found it time-consuming hard work to mark 100+ individual portfolios. According to the conclusions, the portfolio assessment is really beneficial for learners since it engages them in a continuous learning process. Plus, they are led to self-error-correction, discovering new knowledge and independent learning. In conclusion, it was found that Portfolio Assessment is beneficial for both learner and lecturer in assessing language structure competency. However, this should be implemented with some other methods for large classes since it is time-consuming both to compile the book and to evaluate it.*

**Keywords**— **Assessment, Creativity, Critical thinking, Portfolio, Reflection**

## I. INTRODUCTION

### A. Assessment

Assessment is an integral part of formal education, and knowledge is disseminated in different stages namely primary, secondary and tertiary levels. Irrespective of these different stages, assessment is carried out to evaluate the performance of the learners.

The traditional evaluation methods utilized by teachers are paper and pencil exams. They are not skill-oriented. Hence, they do not evaluate learners' critical thinking ability and creativity.

As Gattullo (2000) indicates, formative assessment serves as “(a) an ongoing multi-phase process that is carried out

on a daily basis through teacher–pupil interaction, (b) it provides feedback for immediate action, and (c) it aims at modifying teaching activities in order to improve learning processes and results.” (p. 279). Unlike the summative assessment that takes place at the end of a term, year, or program, formative assessment has its own merits since it provides immediate benefits for both learner and teacher. Also, it should provide feedback for the learner to come to an understanding of his/her strengths and weaknesses. Simultaneously, it should help the teacher to reflect on her/his own instructional methods, materials and level of success. A portfolio, thus, has its significance as a formative assessment method.

### B. Portfolio Assessment

Portfolio assessment (PA) is a recent addition to the Sri Lankan education system. It is a purposeful collection of student work (Arter and Spandel, 1991: 60). Grace (1992: 1) mentions that a “portfolio is a record of the child's process of learning”. In fact, it is an interesting task for many learners since they are able to add some creative designs to it. More importantly, the learners are not expected to take the trouble of cramming some traditional knowledge like in traditional tests. Instead, they are engaged in some practical tasks of accumulating magazine articles, pictures, book chapters, taking photocopies etc. It is clear that this new assessment method directs the learners to independent learning and learner autonomy enhancing their creativity and critical thinking. More importantly, portfolios allow learners, teachers, administrative officers and parents to reflect on the gradual development of the learners. In other words, all these parties can witness what is really going on inside the classroom and the results of the teaching-learning process that takes place inside the classroom.

HND in English (HNDE) is one of the most popular courses offered by the Sri Lanka Institute of Advanced Technological Education (SLIATE), a leading higher education institute in Sri Lanka. This is a two-year full time and two-and-a-half-year part time teacher qualification course. In each semester, assessments for each subject are done both summatively and formatively. 40% of the formative assessment marks are added to the

marks of the summative assessment. Regarding the continuous formative assessments of SLIATE, the lecturers tend to utilize traditional testing methods to evaluate the learners' knowledge. Two or more assessments are conducted within the 15-week semester for one module. Although the present education system of the higher education sector places much emphasis on the knowledge, skills, attitudes, and mindset of the students, assessment methods seem to have been limited to traditional knowledge testing methods. SLIATE is no exception. Therefore, this study was done with the intention of finding out the impacts of portfolio assessment on HNDE learners in ATI Anuradhapura based on the module Language Structure, Usage and Linguistics (LSUL).

## II. METHODOLOGY AND EXPERIMENTAL DESIGN

### I. Sampling Methods

In this study, a purposive sampling method was used. When using this method, the researcher decides what needs to be known and sets out to find people who can and are willing to provide the information by virtue of knowledge or experience (Ilker, 2016: p.2). Since the present research sought to find out an effective assessment method to evaluate HNDE student performance, the most appropriate participants had to be selected from the HNDE followers. The sample was restricted to ATI Anuradhapura.

### II. Sample

The sample was made up of 120 HNDE followers.

#### A. Students

The sample consisted of 120 students of HNDE full time course at ATI Anuradhapura. All these students were following this higher national diploma expecting to become future English language teachers. Their entry qualifications included G.C.E. Advanced Level (A/L) and a credit pass (C) for English subject at G.C.E. Ordinary Level (O/L).

The target group consisted of 120 students from the 2019 full time batch. All the students were from North Central Province, and their age ranged between 19 to 25 years. The members chosen from the 2019 batch were involved in the 1st year first and second semester portfolio making.

### III. The module

The module under research was Language Structure Usage and Linguistics (LSUL). This module was chosen due to the expertise and experience of the researcher who has been teaching this module for five consecutive years.

This module covers grammar and linguistics. However, in the present study, only grammar topics were considered. This is a four credit subject with six hour lectures per week.

In the first year the first semester, eleven topics will be covered. Out of them, five topics deal with grammar: word

classes, simple sentence I, simple sentence II, noun and noun phrase.

In the first year second semester, the students are expected to learn four grammar topics: verbs and verb phrase; active and passive voice; adjectives; adverbs and adverbials. In the second year first semester, the students are expected to learn four grammar topics: expanding the sentence: coordination; Expanding the sentence: subordination; If clauses and cleft sentences.

The portfolio covered all the grammar topics for the given semesters were covered.

## IV. Data Collection Methods

### • Implementation of the Portfolio

The entire process of planning the portfolio was based on the PROVEE.IT (see figure 01) model that supports Collegial Quality Learning Environment (CQLE) (see figure 02) (Bryant & Timmins, 2002) According to CQLE, the teachers "should learn to work together to improve their practice, while helping students develop moral responsibility, ethical responsibility, become humanistic, open-minded, and are able to use authentic assessment" (p.13). Here authentic assessment refers to assessments like portfolios. The PROVEE.IT model describes the responsibilities of the teacher and the student. According to the model, a professional team including the teacher which is called Instructional Team (IT) Plan the purpose, product and process; Reflect on the evidence needed; discusses the Opinion on criteria; set Value for and develops rubrics; Evaluate the portfolios; and Evaluate the process. The students' responsibility is to work together to develop their own portfolios, and to work in class on other projects as well (Bryant & Timmins, 2002, p.18).

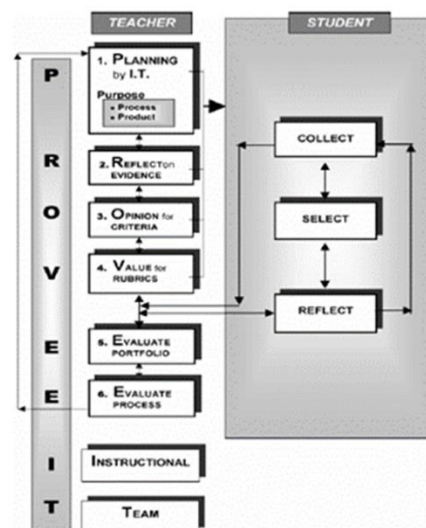


Figure 1: PROVEE IT Model

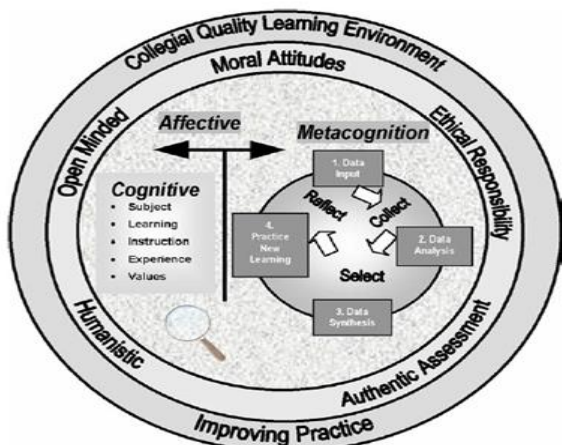


Figure 2: Conceptual Framework for Implementing a Collegial Quality Learning Environment

In the current research, the researcher became the only member of IT since it was an individual project. However, PROVEE.IT model was utilized in the process of portfolio planning, implementation and evaluation. The PROVEE.IT model was used in this study due to its clearness in the stages, reliability and practicality. Moreover, the evaluation rubrics were created to evaluate the learners' knowledge, skills, attitudes and creativity. Basically, their self-learning and dedication were also evaluated.

• Questionnaire

Apart from the implementation of the PA, a questionnaire was used to collect qualitative data-. The questionnaire aimed at obtaining the attitudes, opinions and feelings of the participants towards the PA.

The questionnaire included 22 questions. The closed questions were used to obtain some exact information and the open ended questions were used to provide the participants with opportunities to express their views.

V. Data Collection Procedure

After completion of the portfolios, questionnaires were distributed among all the participants. Both closed and open ended questions were utilized. Simultaneously, twenty randomly selected participants were interviewed for further clarification.

VI. Scope of the research

The current research was based on 1<sup>st</sup> year students who are following Higher National Diploma in English (HNDE) at ATI section, Anuradhapura. The module under research was Language Structure Usage and Linguistics I &II of HNDE course. All the grammar topics of this module except for linguistics topics were covered in the intended portfolio assessment.

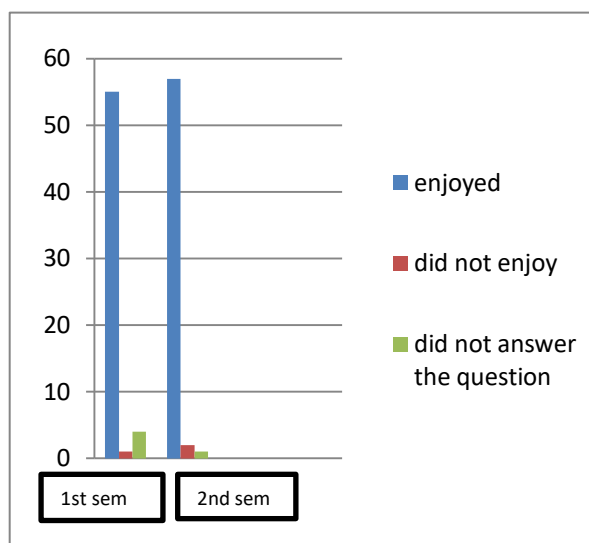
III. RESULTS

I. Questionnaire

After the implementation of portfolio assignments, as the next step of the research, the attitudes of the participants were to be identified and analyzed. For that, a well-designed questionnaire that included 22 questions was distributed among the participants.

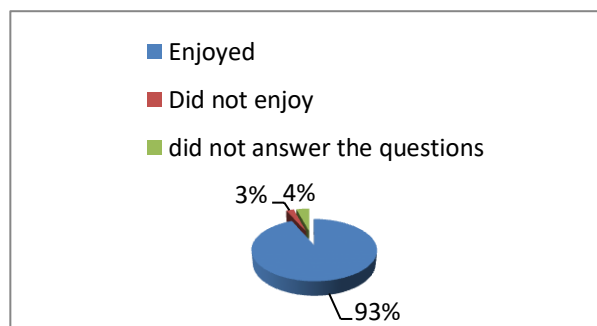
The charts given below display the level of satisfaction they enjoyed after doing the assignment.

Chart I : Willingness towards the Portfolio Assignment: the number of participants



The chart given above indicates the level of willingness towards PA semester wise. In the first semester, two participants said that they did not enjoy doing the portfolio assignment. One participant did not answer this question. 57 said they enjoyed the activity. Some said, they enjoyed it a lot. In the 2<sup>nd</sup> semester, four participants did not answer this question. One participant did not like doing the portfolio. 55 participants said that they enjoyed doing portfolios.

Chart II: Percentages of willingness towards doing PA



The chart II given above indicates the overall percentages of the level of willingness towards PA. According to the chart, only 3% of the population dislikes doing the portfolio assignment and only 4% did not answer this question. 93% of the population enjoyed doing portfolios.

According to the statistics mentioned in the charts given above, it is absolutely clear that the participants are satisfied with the Portfolio Assessments.

Moreover, the data reveal that the lecturers in SLIATE use different methods to assess the learners: Creative activities, presentations, pair work, individual activities, group activities, portfolios, conversations, examination papers, worksheets, speeches, writing short notes, making booklets, oral tests, discussions, dramas, speeches, using pdfs, PowerPoint presentations, class tests and English fair. It was also apparent that the participants were aware of the PA even before the researcher introduced them to this assignment. However, the process of PA was complex for both the researcher and the participants. Nevertheless, the interest and usefulness of the assessment have remained in a higher level .

## II. DISCUSSION AND CONCLUSION

### A. Impacts of PA on the participants

#### I. Uses of the PA

As the participants mentioned, to be able to make the portfolio, they should cover reading the entire syllabus, and thus it becomes a booklet that includes all the notes for their entire syllabus. As a result, they can use their portfolio as a study guide especially when they prepare themselves for the semester-end examination.

As a few participants mentioned, this task improved their organizing skills. A few more participants highlighted that learning word classes thoroughly through portfolio was extremely important for them.

#### II. Extra information

In making the portfolio, they referred to their lecture notes; they read short notes; and they took a great effort to find extra notes from many books, internet etc. So, while making the portfolio, the participants were able to learn many things related to language structure usage and linguistics. As a result of their search, they could find new things that they did not mean to find. This new knowledge was very useful for them. They found many examples for each lesson from various sources.

As many participants emphasized, they might not read extra information unless the portfolio comes as an assignment.

#### III. Doing exercises

Also, they found many exercises for each lesson from books and internet, which really helped them to correct their mistakes and improve their subject knowledge. Doing exercises was not a habit of some students, but they were compelled to do many exercises relevant to each topic, which was greatly helpful for them at the examination.

#### IV. Doing Past papers

They also discussed about the past papers that they had to do for the portfolio. In fact they were asked to do two recent past papers and attach them to the portfolio. As they mentioned, the past papers provided them with an understanding about the structure of the oncoming paper of the examination as well as the structure of the questions too.

#### V. Memorization

As almost all of them agreed, making portfolio becomes an opportunity for the participants to go back to their lessons and re-read their notes, and this act helps them memorize their lessons. As one participant mentioned, memorizing was a problem in the past, however making the portfolio has become the best solution for this problem. This process of re-reading is called a second chance of learning the lesson by a participant. This deep study brings back the memories of their past knowledge.

#### VI. Correction of grammar errors

Also, the assignment has helped them to find new methods of correcting their grammatical errors. Sometimes, this work reminded them of certain structures that they had already forgotten. Furthermore, the assignment has helped them find out the rules of writing proper sentences.

#### VII. Creativity

Since they try to beautify their book by painting, pasting pictures, and etc. this activity provides the participant to improve his/her creative abilities. Especially, they try to present the cover page very creatively. As one participant mentioned, s/he is into working hard and involves in this activity seriously. The portfolio is a memorable object for this participant especially because of the creativity added to it. This work also becomes a way of displaying the participant's talents.

#### VIII. Examination preparation

Also, this task of making the portfolio has helped the participants prepare for the examination. Basically, it is because of the fact that they write down extra notes, short notes, examples, do past papers and re-write lecture notes that they felt they are fully prepared for the examination. They commented on the short notes which they attached to the portfolio. These short notes really helped them for the examination.



**B. PROVEE I.T. Model**

**I. Instructional Team (I.T.)**

Following the guideline of the PROVEE IT model, first the IT was decided, which was limited to the researcher herself. She decided on the nature of assessment and the implementation of it conforming to the assessment rules laid by SLIATE. Since she was the lecturer who taught the subject, Language Structure, Usage and Linguistics (LSUL), she was aware of the content and the time allocation for each topic, she decided that she would have the portfolio assessment as the continuous assessment for the LSUL subject.

**II. Planning**

As she planned, she would do class activities to do inside the classroom and the students will have to attach them to the portfolio. Also, her main purpose was to direct students to self-learning and reflection. Accordingly, she assigned them to do exercises for each sub topic of every topic. Also, she assigned her students to collect as many extra materials as possible from books, newspapers, the internet etc. She did not limit them to any number in terms of pages since her purpose was to direct them for hard work through self-learning. Moreover, she directed them for exam preparation by asking them to do two recent past papers on their own.

**III. Reflection**

As it was mentioned in the previous section, reflection was aimed at this PA. Reflection occurred in three levels. Their huge portfolios enabled the learner to become aware of what he/she had learned; how he/she had learned; if he/she is ready for the end-semester examination. Most of the learners expressed in their questionnaires that they were really satisfied with the load of work they had completed. They could go back to what they had learned and it really gave them a good organization. All these jobs helped them a great deal in exam preparation.

Next, the researcher, being the teacher (lecturer), could reflect on what she has done at the end of the semester. As the only member of the IT, she could identify how much effort the learners had taken to accomplish this task while really engaging in the task. She realized that the learners had the opportunity to plagiarize, yet according to her instructions, the learners had to finish the work by hand. In this manner, at least while writing, the learner had been able to become knowledgeable about the subject matter.

Finally, the parents could reflect on what their children were doing in HNDE classrooms. In the questionnaires, some participants mentioned that their parents were really happy with their massive work. They could have a look at the book and see if their children were really learning too.

**IV. Opinion on criteria and value for rubrics**

This was decided by the IT, based on the content of the syllabus. The distribution of the marks is included in the tables given below.

Table 1.  
Marking Rubrics for the Portfolio Assignment

	<b>Cont ent /50</b>	<b>Langu age /30</b>	<b>Creativ ity /10</b>	<b>Struct ure /10</b>
Excellent	44-50	28-30	9-10	9-10
Very good	38-43	24-27	8-9	8-9
Good	25-37	17-23	5-7	5-7
Satisfactory	18-24	10-16	3-4	3-4
Weak	0-17	0-9	0-2	0-2

Table 2.  
Marking rubrics for the content of the Portfolio Assessment

	Classroom activities (Submission Marks) /5	Lecture Notes (submission Marks) /5	Extra Notes /10	Past Paper (done by the learner) /10	Past Paper Submission Marks 05	Exercises (selected 20 questions) /10	Exercises (other exercises) Submission Marks /05
Excellent	5	5	9-10	9-10	05	9-10	5
Very good	4	4	8-9	8-9		8-9	4
Good	3	3	5-7	5-7		5-7	3
Satisfactory	2	2	3-4	3-4		3-4	2
Weak	0-1	0-1	0-2	0-2		0-2	0-1

As table 01 given above displays, IT has decided to provide 50 marks for the content; 30 marks for language; 10 marks for creativity; and 10 marks for the structure. Marking ranges have also been clearly mentioned in the tables given above.



## V. Evaluation and evaluation process

Evaluation of the portfolio was the main responsibility of the IT. This was done conforming to the marking criteria and rubrics presented in Table 01 and Table 02. In the evaluation, knowledge, language competency, reflection, self-learning, hard work and creativity were taken into account.

As it is clearly shown, the content is allocated the highest number of marks, for it is very crucial in the assessment. As it is mentioned in the previous sections, the content includes classroom activities, lecture notes, past papers, exercises, and extra notes. Table 2 given above describes how marks have been allocated to each section. Under content, marks were given based on two levels. The first layer included reflection and self-learning and the next layer covered a grammar and knowledge check. Based on these levels, some items were selected for marking and the rest was given marks for the extent of self-learning they had done. For the marking purpose, 20 randomly selected questions from the exercises section and the past paper done by the student alone were marked and provided the deserved marks. In the next level, submission marks were given for classroom activities, lecture notes and the past paper done inside the classroom while extra-note collection and exercises were given marks based on their hard work and self-learning. In the case of the latter, the IT had to become subjective to a certain extent, for it was difficult to measure their hard work. However, if the learner had proven of sufficient hard work and self-learning, he scored full marks, while careless work done with less attention was given low marks.

In addition to content, 30 marks were allocated for language, 10 marks for creativity, and 10 for structure. In the case of language, accuracy, spelling, lexical resource and use of cohesive devices were taken into consideration. Also, the language use of written pieces done by the student was considered in this regard. The structure included the layout of the work. This checked on the arrangement of the entire documents in order, binding and handwriting. The creativity was the next section. This is a really subjective aspect. Therefore, it was looked at in different angles. This was basically marked on the overall presentation of the book: how creatively it is presented; how neatly it is presented; or overall personality presented through the work. In this case, the IT was in the understanding that the creativity is a part of the personality of a learner and it could differ from one learner to the other. Therefore, in giving marks, the uniqueness of each learner in presenting his work was fairly rewarded.

## VI. Implementation of the PA

The PA is a huge task. It needs planning on the part of both the teacher and learner. The participants had to spend much

time day and night in collecting the materials, organizing them and compiling them as a huge book. This task was a combination of cognitive skills and physical energy. The participants had to collect different materials and think about how to present it creatively to the lecturer in order to gain marks. They had to make sure they had every lecture note that the lecturer provided them. Plus, they had to organize extra material collection while finding exercises for each topic. The entire task required planning organizing and implementing skills from the learner. This could be named as learner autonomy. The participants had the opportunity to do everything on their own thus providing them opportunity to test their ability to taking responsibilities and carrying them out successfully.

## VII. Advantages of the PA

According to the experience of the participants in the implementation of the PA, an English language learner can be benefitted from this method. Familiarity with the content of the subject is a great advantage that the learners enjoyed after completing the portfolio. This enabled them to face the exam confidently. Also doing the past paper helped them to a great deal in exam preparation. In this manner, it is clear that this is an ideal method of getting learners prepared for the oncoming examination. Furthermore, collecting extra notes was a good idea since the learners are able to expand their knowledge on one topic. In the same manner doing extra exercises could help the learner correct their own mistakes. The next advantage is the memorization. Through the PA, the learners are able to memorize the content of the lessons since they re-read and re-write the information. Another advantage is that the learners are able to find new ways of grammar correction. This assessment also assist learners go back to their school days and remind them of what they have already learnt. Plus, the learners are provided opportunity to present their creativity or their talents to the lecturer. Also, this enhances critical thinking, independent thinking and organization skills of the learner.

Moreover, through this assessment the learner, the teacher and the parent is able to reflect on what the learner has done throughout a semester. A learner is able to understand how much he/she has learnt while the parent is able to watch continuously what is going on with his child. Plus, the teacher is able to come to an understanding about the progress of her/his learner. Or he/she is able to check her/his own success or weaknesses and adjust herself/himself accordingly.

## VIII. Disadvantages of the PA

The main disadvantage of this assessment is the time constraint. It is a time-consuming task. Since the learner is doing the task on his/her own, they are able to cheat the lecturer to a certain extent.

On the part of the lecturer, it is a time-consuming hard work to mark the final product. Since the collection of materials come as a huge book, the lecturer needs to spend much time on marking one portfolio. This is a huge Overall the PA is beneficial for the learner although there are practical issues in implementing it in the classroom level.

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disadvantage for the teacher. Also, in HNDE classrooms, there are 100+ students. In such large-sized classes, the lecturer finds it difficult to spend so much time on marking individual assignments. That takes much valuable time of the lecturer.

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# Investigating the Integration of Blended Learning Tools to Provide Formative Feedback on Students' Writing in Secondary level ELT Textbooks in Sri Lanka

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**Abstract**— *Blended learning is an educational model which makes use of both traditional face-to-face classroom settings and online learning environment. Blended learning approach provides more freedom to adjust the learning process according to learner needs. With the advancement of modern technology, blended learning uses a variety of new ways that can optimize the maximum benefits of traditional teaching methods. In the English Language Teaching (ELT) field, blended learning can be successfully used in several ways in teaching and when giving formative feedback. Formative feedback is an ongoing process which makes learners reflect on their own work and evaluate their learning and providing formative feedback on students' writing drafts increases their confidence and develop better writing practices. This study aims to analyze a secondary English language textbook to determine the extent to which it incorporates blended learning aspects to provide formative feedback on writing. The study also aims to provide suggestions on effectively integrating blended learning aspects and formative feedback into textbooks. The methodology employed in this study involves a textbook analysis which carefully examined the content of the material. Various aspects of blended learning, such as the inclusion of online resources, interactive activities, multimedia materials, and opportunities for self-directed learning, are examined. Also, the analysis identifies the strengths and weaknesses of the textbook in relation to formative feedback aspect and highlights areas where improvements can be made. Such suggestions are based on best practices and emerging trends in blended learning pedagogy and they provide practical guidance to educators.*

**Keywords**— **ELT, Blended learning, Formative feedback, Textbook**

## I. INTRODUCTION

In the modern era, blended learning has become an umbrella term in the field of education. According to Graham (2006), blended learning is “a learning system which combines face-to-face instruction with computer-

mediated instruction” (p. 05). This approach is also known as “hybrid learning”. Garrison & Kanuka (2004) define blended learning as “the thoughtful integration of classroom face-to-face learning experiences with online learning experiences” (p. 96). The blended learning approach is widely used in educational contexts and has become more popular as a result of the COVID -19 pandemic and it is used in some Sri Lankan universities and educational institutions too. This approach serves distinctively in the education field due to the convenience of its implementation. It is believed to enhance learner engagement and help them to achieve their learning goals easily.

In blended learning, learners can be exposed to both synchronous and asynchronous learning opportunities. Synchronous learning refers to the teaching and learning that happens where learners are learning in a real-time classroom setting and it can be either a face-to-face setting or a virtual platform such as web conferencing on Zoom/Teams (Bower et al., 2015). Asynchronous learning is where learning happens outside the class time, and learners can learn from anywhere and anytime. There is no real-time classroom, and all the content needed is already made available for learners (Martin & Oyarzun, 2017). Combined synchronous and asynchronous learning features maximize the benefits of learning in a blended learning approach. For example, asynchronous option provides the learners an opportunity to work on their own (e.g., researching, collecting information, and writing individually), which increases their critical thinking ability, creativity, and autonomy. It also makes learners ready for the synchronous class. In the synchronous class, they can discuss/share what they have learned, which increases their critical thinking and problem-solving skills (Chou, 2002).

## II. USE OF ONLINE TOOLS AND RESOURCES FOR EDUCATIONAL PURPOSES

According to Kaya (2015) integrating a Virtual Language Environment (VLE) into the English language teaching procedure maximizes the benefits of learning conditions

from the constructivist perspective. Integration of different kinds of activities on the VLE or other online platforms allows students to develop different skills (Castañeda & Arcila, 2012). Castañeda & Arcila (2012, p.78) note that "...activities designed to be used with technology can provide students interactivity and, at the same time, can enhance critical thinking, creative thinking, research skills, and social skills." A VLE can self-directed learning content available on other platforms such as YouTube, Quizlet, and Duolingo. Tools such as DingTalk, Hangouts Meet, Teams, Skype, WeChat Work, Padlet, WhatsApp, and Zoom also can be integrated into the VLE.

Since most of the online resources in Internet content are based on the genre of text and students' materials and activities are done online, there is always a strong element of reading practice. There are vast resources of varied, interesting material on many different levels of language, and it is only up to teachers to make use of it for the benefit of their learners in order to develop their reading comprehension. In order to incorporate the technology into teaching plans, language teachers are seeking innovative teaching methods and have become increasingly interested in recent developments in modern technology which support the diversity in language learning methods and the vast amount of information linked by hypertext on the Web. It is invaluable, especially for self-regulated learners and they are given the freedom to encourage in "manage the learning process independently and to explore linked pieces of information nonsequentially on the basis of their personal preferences and needs" (Son, 1998: p. 121). Most of the Internet sites with various audio materials, online Text-to-Speech (TTS) software, and readymade or teacher-prepared audio exercises contribute to developing pronunciation awareness and skills of the learners and it is very useful for both teachers and learners in a language classroom. When creating pronunciation practice materials, the most common teaching method used in prevalent language education begins with sound discrimination and articulation, moves on to longer complex phrases, and concludes with communicative tasks or dialogues which are intended to practice language production in a target discourse. (Krajka, 2007). Making a quick search on a search engine can provide teachers and learners with class syllabi from primary school to university level with lecture notes, homework tasks (and answers), assessments, questionnaires, and video lectures which are available for free. It seems that the usefulness of online tools and resources may also promote the dissemination of high-quality materials for free and contribute to equalising the field for those who have been underprivileged till now in terms of education. Having a proper awareness of online tools and resources may even lead to greater competency towards learners and teachers in creating inclusive learning environments in their language classrooms. Teachers need

knowledge and competence regarding online tools and resource possibilities in order to encourage learners' decisions about the most suitable technological tool and resource. Not only that, but teachers should also be able to fulfil learners' needs and accessibility requirements of the online tools and resources that they use in their language learning classrooms.

### III. IMPORTANCE OF STUDY

Despite the increasing popularity and integration of blended ELT classrooms in Sri Lanka, there is a notable lack of comprehensive research exploring the effectiveness and implementation of using blended learning to promote formative feedback specifically focused on writing skills in the English language curriculum in Sri Lanka. While numerous studies have investigated the impact of blended learning approaches and formative feedback in various educational contexts, there remains a lack of empirical research that specifically addresses how a blended ELT classroom environment promotes the utilization of formative feedback strategies in order to enhance students' writing proficiency. Also, there is a lack of research on its effective integration within the school curriculum for secondary-level students in Sri Lanka, particularly in the context of blended ELT classrooms. This research gap hinders the development of evidence-based pedagogical practices and may limit the potential for optimizing language learning outcomes in this specific context (Pushpakumara, 2022). This research gap has been formed due to the lack of knowledge about effectively developing and integrating formative feedback techniques into the blended ELT curriculum to meet the specific requirements, language proficiency levels, and cultural identities of secondary-level students in Sri Lanka. There is also a lack of research into the difficulties and opportunities that teachers encounter when implementing formative feedback on writing in a blended learning environment. Therefore, a deeper investigation into the curriculum design, lesson delivery, and learning outcomes of providing formative feedback on writing within the framework of a blended ELT classroom in Sri Lanka is empowered to inform educators and policymakers to improve the quality of English language education in the secondary level of schools in the country (Indrarathne & McCulloch, 2022). Therefore, it is necessary to investigate the most appropriate formative feedback approaches, digital tools, and instructional strategies that are compatible with the national curriculum and meet the specific learner needs in blended ELT classrooms in secondary education in Sri Lanka.

A comprehensive study done by Gunawardana (2015) presented valuable insights into Sri Lankan government school English language textbooks. According to this study, Teacher's Guides available for the primary level

English textbooks encourage teachers to give feedback on students' performances but it does not encourage teachers to use blended learning tools in the process of giving feedback. Not only when giving feedback, but also the study examined that primary level English textbooks does not encourage any use of blended learning tools in the process of language teaching and learning.

Many studies in this area have been done based on the higher education field (Karunanayaka et al., 2021; Liyanagunawardena et al., 2014) and there is a lack of studies that have been published on the topic of blended learning integration in the secondary level textbooks in Sri Lanka.

Therefore, the study aims to address the following research questions.

- A. *How well grade 7 English language textbook incorporate strategies for blended learning and formative feedback on students' writing?*
- B. What are the suggestions for integrating formative feedback on writing in the school curriculum for secondary-level students in the blended ELT classroom in Sri Lanka?

#### IV. METHODOLOGY

The study utilized textbook analysis in order to obtain data which systematically analysed the content and instructional design. Using this systematic analysis, the study has analysed Grade 7 English Pupils' Book, Workbook, and Teacher's Guide, focusing on their content and pedagogical strategies in order to address the research questions. Additionally, a thorough content analysis has been done through conducting a keyword search on the selected materials.

#### V. FINDINGS

The study has utilized textbook analysis in order to obtain data. Using this systematic analysis, the study has analysed Grade 7 English Pupils' Book (Education Publications Department, 2019), Workbook (Education Publications Department, 2020), and Teacher's Guide (National Institute of Education, 2016). The Pupils' book contains ten units and among them, the study has focused on the writing activities in Units 2, 3, and 6 where some writing activities are found. The title of the pupils' book unit 2 is "Friends Indeed" and activity 3 is a poster designing activity. According to the activity instructions, it encourages students to collaboratively work with their peers but it does not encourage peer feedback or the use of online tools. Activity 6 of unit 3 titled "Pleasure" is about constructing a story according to the given clues. This activity enhances the creativity of the learners but it does not encourage any peer feedback or use of online

resources. Unit 6, activity 4, "Better Safe Than Sorry" is about formal letter writing and it does not indicate giving any peer feedback or use of online tools as in other writing activities mentioned above. The research findings also found that there is not any aspect of formative feedback or use of online tools in the grade 7 English Workbook.

The study has also analysed the Teacher's Guide of grade 7 English syllabus to see even if teachers are given any instructions on providing formative feedback. But the Teacher's Guide also does not provide any tips related to formative feedback or using online tools. A keyword search was conducted on the Teacher's guide and the terms such as "feedback, blended learning, and online tools" did not appear even on one occasion. The analysis highlights that these concepts have not been taken into consideration in preparing ELT materials for grade 7 students. Guide in order to address the research questions.

#### VI. SUGGESTIONS

Effective integration of formative feedback and the use of blended tools in the curriculum at the secondary level can provide students with valuable insights into their writing strengths and areas for improvement. In order to effectively integrate blended learning strategies to provide formative feedback into secondary level textbooks, curriculum developers should consider inculcating the following suggestions.

When designing the curriculum for secondary-level students, syllabus designers can utilize a system which allows learners to track their learning progress by entering their scores. In order to implement this, the Teacher's Guide should instruct teachers to give scores for activities in pupils' book. In the pupils' book, there are some activities in which students need to listen to audio clips and then answer the questions. Although there are such activities, teachers are not provided with a DVD which includes the audio files. So, as a suggestion, the teacher's guide should come with a DVD including audio files and the audio files also should share among class students by the teacher. Teachers can use cloud uploading web tools for this purpose. The pupils' book should include online assessments, quizzes, and exercises which students need to use computers in order to complete. For this, teachers need to allocate one English period in a week to be held in the computer lab in school to make students use the computers to do the activities. Such activities can design using web tools such as Padlet, Write & Improve, and Kaizena in order to provide immediate feedback for students right after they have completed the task.

It is also really important to inculcate activities that encourage students to provide feedback to their peers. Curriculum developers can include tasks where students

need to review and provide constructive feedback on their peers' work. As mentioned above, for such tasks students can use web tools in order to provide feedback. Also, teachers should be given a comprehensive guide on how to provide formative feedback in a blended classroom effectively. The guidelines should include strategies and techniques for personalized feedback using digital tools, error correction, and encouraging students to reflect on their learning process. Providing feedback will help students understand their strengths and weaknesses. Therefore, the feedback rubrics should be included in the pupils' book as well as in the Teachers' Guide with detailed explanations. Due to these rubrics being used by grade 7 students, they need to be simple to comprehend.

By utilizing online platforms that support writing activities will facilitate teachers in providing constructive feedback and correcting written assignments of students. In order to successfully implement this, the Teachers' Guide should include guidelines on how to effectively use online tools for this purpose and also the guide should provide links for teachers that can be used to give feedback. Not only that, in order to provide feedback on learners' speaking tasks, teachers can record the feedback and send it to learners in a blended classroom and this enables teachers to assess learners' pronunciation and speaking skills while providing personalized feedback. Therefore, it is necessary to integrate listening and speaking tasks into secondary level curriculum which can be completed using online tools. While doing such activities, learners may feel less motivated to use online tools to complete the task. For this, the Teachers' Guide should provide tips for teachers to make students interested towards the tasks and make them successfully use online tools.

#### *IV. Encouraging Peer Feedback in a Secondary Level Blended Classroom*

According to study findings, grade 7 English pupils' book does not encourage the use of online tools to provide peer feedback. Due to this reason, teachers can implement the following strategies to encourage peer feedback in a secondary level classroom.

In order to help students to understand the purpose and structure in the process of peer feedback, teachers can provide clear guidelines and expectations for giving and receiving feedback. They can also provide secondary level students with specific criteria or rubrics to assess their peers' work. Another strategy is to incorporate peer feedback into collaborative activities where students have the opportunity to provide feedback. Moreover, teachers can model effective feedback techniques in order to facilitate peer feedback. Also, integrating online platforms such as Padlet, Write & Improve, and Kaizena can enhance the convenience of peer feedback in a blended classroom.

Such tools enable students to provide feedback asynchronously, allowing them for flexible and increased participation. As blended learning continues to evolve, incorporating peer feedback strategies empowers students and prepares them for success in both their academic and professional lives. These strategies should be included in the Teachers' Guide with detailed explanations on how to successfully implement them.

These suggestions and strategies can be utilized in order to effectively integrate the use of blended learning and formative feedback techniques in secondary level ELT classrooms in Sri Lanka.

## VII. CONCLUSION

Blended learning environments are necessary for innovative teaching and learning. With the advancement of technological development, various web tools have emerged that help both teachers and students. Some web tools help teachers to provide effective formative feedback on learners' written work. Using such tools, not only teachers but also students will get the opportunity to provide feedback. Automated feedback tools such as Write & Improve facilitate learner autonomy and help with learners' ongoing progress in their language learning. Also, teachers can maintain a portfolio based on learners' written performances which helps teachers to monitor learner progress. The use of online tools in secondary level ELT classrooms offers the potential for interactive and engaging feedback methods, enhancing student motivation, and participation. Inculcating appropriate suggestions and strategies on the use of blended learning tools will be influential in the development of secondary level ELT field in Sri Lanka.

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exploration by participating in both local and international research conferences. Thashmira Rajapaksha possesses a keen interest in contributing to the field of TESOL through extensive research endeavours.

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# The Digital Transformation of Higher Education in Sri Lanka due to Covid

-19

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**Abstract**— *Digitalization in education can be defined as the implementation of digital technologies to transform knowledge for learners and as well as educators. Digital technology has made a phenomenal entrance into Sri Lankan higher education during the Covid 19 pandemic since the Sri Lankan government followed the social distancing step to limit the spread of the syndrome. This study will elaborate answers to the issue; to what extent the steps taken by the government and private sectors have been sustainable in facilitating the e learning during the Covid - 19 outbreak. Therefore, the study is crucial in determining whether the steps above that have been taken to make online learning in Sri Lanka, are feasible with the real-world challenges that Sri Lankan university students encounter. Taking a quantitative research approach; a questionnaire, the paper observed the usage of digital platforms before and after the pandemic situation, some issues faced by the university students with the digital transformation, some steps taken by the authorities and to what extent, they have been sustainable in the higher education in both academics and economics. Furthermore, there are some recommendations for how to resolve the problems and improve the sustainability of the digital transformation in the future. In terms of the conclusion, it can be stated that Sri Lanka's digital transformation is at a sustainable level during the pandemic, and even after the outbreak, and it has a beneficial impact on education in the country's higher education system.*

**Keywords**— **Digital transformation, Sri Lankan higher education, Covid-19 pandemic, Digitalization, Sustainability**

## I. INTRODUCTION

### A. Background of the study

Covid 19 pandemic impacted the economies, tourism, education, and foreign relations of almost every country in the world. Similarly in every other country, the epidemic produced an impact on Sri Lanka's development in various manners, particularly in the area of education. Since conventional educational programs were not practical to be continued due to the COVID-19 pandemic, university

education was nearly entirely completed online. The governments avoided large gatherings of people and managed the space between individuals as a result of the COVID 19 pandemic. This had a significant effect on the educational field and gave scope to resume educational activities as part of the measures that were adopted to stop the plague's spread. This led to the rise in popularity of terms such as "e-learning," "blended learning," "online education," "web-based education," "web-based instruction," and "online courses" in the educational community. Although students and teachers in Sri Lanka have been using e-platforms like email, Microsoft Office, and Google Drive, they were not aware of the utility of other platforms like WhatsApp, Messenger, and Viber for educational purposes like document sharing and communication that support group projects. After the pandemic, Zoom and Microsoft Teams gained recognition as a video conferencing service that gave teachers and students an opportunity to meet online synchronously on a personal computer, laptop, or mobile device with or without using video. These platforms were significant because they enabled virtual interactions between students and teachers, such as nonverbal feedback and replies, breakout rooms, and screen sharing. For giving online lessons, they also became accustomed to using Zoom and the Learning Management Systems (LMS).

### B. Sustainability of e – learning

Additionally, it is possible to see that many students and lectures are still using E-learning even now, after the epidemic. Although it is not used as frequently as it was during this outbreak time, the university sector adopts a "hybrid" approach that alternates between face-to-face and online learning. Also, studies show that, college students, professors, or instructional designers could choose and use tools and practices that improve the effectiveness and efficiency of self directed learning throy with technology encounters. The strength of effective usages of digital technologies in designing and delivering education leads to the sustainability of the e- learning process. This, highly depend on the facilities that have been provided by the government sector and the private companies that hold

power to facilitate the usage of e learning. The Ministry of Education is also changing the curricula to be more student-centric than teacher-centric, allowing students in the universities to engage in more independent study and take full advantage of the benefits of the readily available inclusive e-study platforms. To websites like the National Learning Content Management System to undergo textbook analysis/Learning Management System (LMS) and all official e-Learning platforms of State Universities under the jurisdiction of the University Grants education sector and to what extent that transformation in higher education has been sustainable during the pandemic and as well as until today

### C. *Litrature review and the problem matter*

The study “Forced and Unplanned Digital Transformation of Education in Sri Lanka during Covid-19 Crisis” which was done by Shashini Rajaguru (2021) aims to understand the challenges faced by a primary school located in a relatively rural area in Sri Lanka. . Another study named as “ Transition to online education in Sri Lanka during COVID-19: A descriptive phenomenological study” which was done by S.P. Kalpana Jeewanthi Subasinghe, A. M. Shyama Deepanie Pathirane, S.P. K. J. Subasinghe (2022) explores how teachers in rural schools experienced the lockdown in relation to their teaching role during the pandemic. The study had found several challenges within the five aspects; (1) adjustment to the online teaching/learning process; (2) experience of challenges; (3) experience of new opportunities; (4) impact of parental involvement; and (5) impact of teachers’ and children’s physical, psycho-social well-being.“ The dark side of online home-schooling after Covid-19 in Sri Lanka” done by Mohamed Yaseen, Minnathul Suheera Thaseem and Mohamed Fathima Wazeema (2022) aim to determine the impacts of current home-based educational activities on low-income families in Sri Lanka. The findings revealed that most of the students from low-income families are unable to engage in the online learning process at home, learning activities of children have become a burden to the parents and parents temporarily abstain their children from learning in some families.

According to Jayatilleke and Gunawardena (2016), this significant dicussion on perceptions has not throughly been analyzed as a matter of fact. Concern before transferring from traditional to online education platforms has eventually led to a conundrum around online education. Also, undergraduate perception of the transition is extremely contentious, according to L.Smart & J. Cappel (2006), as there are both positive and negative responses. These are some of the studies which was done in order to investigate the digital transformation of Sri Lankan education during the Covid-19 pandemic period. But there is a lack of investigations specified into the

higher. education sector and to what extent that transformation in higher education has been sustainable during the pandemic and as well as until today.

### D. Research Question

To what extent the digital transformation in Sri Lankan higher education has been sustainable both during and after the Covid-19 pandemic?

## II.METHODOLOGY

This research has been conducted in four primary stages, which are as follows: As the first step, in order to determine which topics should be covered in the questionnaire, it was first necessary to browse papers that were similarly done depending on the research topic. Secondly, creating the survey questionnaire as a means of gathering data. Analysis of the survey results was done as the third step to obtain the patterns and similarities of data which was followed by drawing conclusions and making recommendations based on the analysis' findings as the last step. The methodology was developed based a questionnaire survey that was designed and presented to university students who have been learning both during, and after the pandemic and who have the opportunity to compare traditional instruction with pure online instruction since they have participated in both online and in-person learning throughout their academic careers. Students at universities were sent the questionnaire survey using apps like WhatsApp, Instagram, and Messenger. It was possible to receive 87 responses from undergraduate students encompassing both public and private universities in Sri Lanka. The participants claim to come from a variety of geopolitical backgrounds, with the majority being from the western and southern provinces but representing all provinces in Sri Lanka. Additionally, it can be observed that 43% of the students attend state colleges, while 57% attend private universities, whom represent a variety of academic fields, and comprise different university years. The questionnaire includes four sections and was created using both open-ended and close-ended questions. The initial part of the survey was made to gather information about the participant's socioeconomic status and demographics, while the second section was made to gauge how conversant undergraduates were in e-learning. The third section was designed to gather undergraduates' impressions of e-learning whereas the final section collected undergraduates' practices in e-learning, which essentially evaluated a participant's e-learning experience.

## III.QUANTITATIVE ANALYSIS

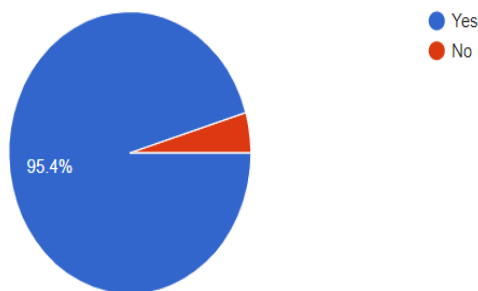
The sections and the questions included in it are selected from the questionnaires of the existing paralal studies whereas new questions were also added based on the limitations of those studies and intuition.

## A. Knowledge of the undergraduates on E-Learning

### 1. Familiarity with E-learning

The purpose of the questions in this section are to evaluate the digital literacy of the undergraduates. According to the survey results, 95.4% of the undergraduates polled are conversant with e-learning, compared to 4.6% who are not. This indicates the group being surveyed has a high degree of knowledge and exposure to e-learning. The commanding majority of 95.4% indicates that E-Learning has significantly obtained popularity and recognition among the undergraduates questioned. This data suggests that a significant proportion of students have used digital materials, online learning platforms, or other types of E-Learning. The considerable familiarity with E-Learning suggests that it has emerged as a significant and distinctive characteristic of contemporary education. On the other side, a smaller number of undergraduates—4.6%—are unfamiliar with e-learning. This group of students may be less familiar with or knowledgeable about e-learning techniques, platforms, or resource

Chart 1 - Familiarity with E-learning



Source: Data collected survey

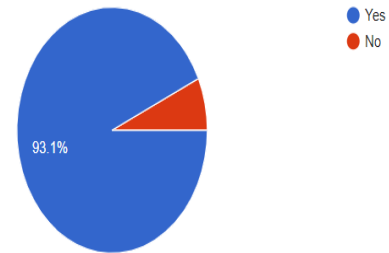
It is important to investigate the causes of this unfamiliarity as there are many potential causes, including lack of access to technology, cultural barriers, or individual preferences for traditional methods of education. Overall, this descriptive research shows how commonplace E-Learning is among undergraduates, demonstrating how central it has become to modern education.

### 2. Competency in using LMS and MOODLE

The result of the survey also shows that 93.1% of the respondents are familiar with LMS and Moodle, whereas 6.9% are not. This suggests that the population being polled has a rather high degree of knowledge and familiarity with these technologies. A significant fraction of the respondents, as indicated by the high percentage of 93.1%, have knowledge of and experience with LMS and Moodle. While Moodle is a well-known open-source learning platform commonly used in educational contexts, a learning management system (LMS) is a software program that makes it easier to organize, distribute, and

track online learning content. The high level of familiarity with these technologies shows that a significant percentage of the people being polled has adopted and accepted them. On the other side, only a fraction of respondents—6.9%—are unfamiliar with LMS and Moodle. Due to reasons including restricted access to educational technology or individual preferences for conventional learning techniques, this fraction of respondents may have little experience with modern tools.

Chart 2 - Competency in using LMS and MOODLE



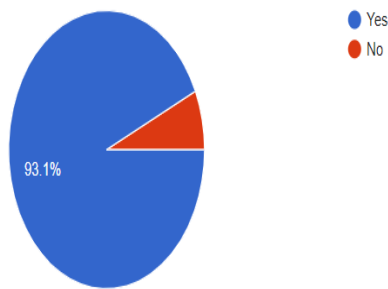
Source: Data collected survey

This descriptive study reveals the respondents' general experience with LMS and Moodle. The findings imply that most respondents have used these platforms, which points to their broad adoption and application in educational contexts. This familiarity suggests that respondents have probably used the tools and advantages offered by LMS and Moodle, such as accessing course materials, taking part in online conversations, submitting assignments, and getting involved in collaborative learning activities.

### 3. Familiarity with E-conferencing

According to the research, 93.1% of the respondents are familiar with web conferencing, while only 6.9% are not. This shows that the population of the survey has a high degree of knowledge and expertise with internet conferencing. The overwhelming majority of 93.1% indicates that a sizeable proportion of the respondents had knowledge about and experience using web conferencing systems to conduct meetings, presentations, or collaborative sessions. A lesser proportion of respondents (6.9%) state they are unfamiliar with web conferencing, suggesting that some may have had little exposure to or experience with this technology.

Chart 3 - Familiarity with Online Conferencing

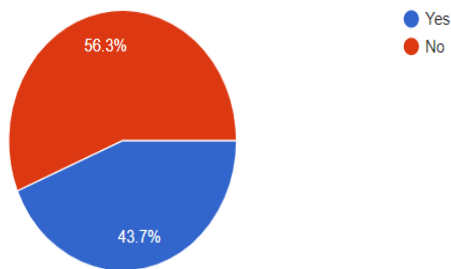


Source: Data collected survey

#### 4. Receiving of a formal training on E- Learning

According to the data, among those surveyed, only 43.7% have had formal training in e-learning, while 56.3% have not. This shows that a sizable chunk of the population polled has received formal training or education that has been especially tailored to online learning. A large number of respondents may not have had the chance or exposure to organized E-Learning programs or courses, as indicated by the greater percentage of 56.3% who have not received official training. This research emphasizes the opportunity for organizations and corporations to close the gap by offering more extensive options for training and professional growth connected to E-Learning techniques.

Chart 4 - Receiving of a formal training on E- Learning



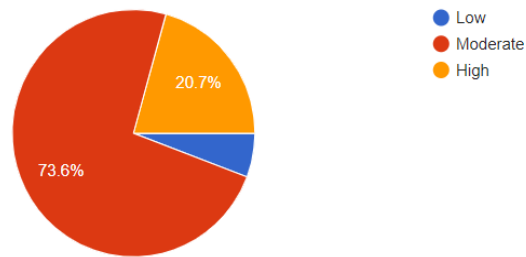
Source: Data collected survey

#### 5. Rating the knowledge on ICT.

In the research, among the respondents, 5.7% assess their understanding of ICT as low, 73.6% rank it as moderate, and 20.7% rate it as high. This suggests that the majority of the population that was polled has an average amount of self-perceived competence of ICT. It implies that a sizeable percentage of respondents have a good grasp of and familiarity with several ICT-related topics. It is important to note that just a tiny fraction of respondents rank their knowledge as being inadequate, suggesting a possible need for more instruction or assistance in this area. This research emphasizes the significance of

continued ICT education and professional development activities to improve digital literacy and equip people with the abilities necessary to properly use technology.

Chart 5 - Rating the knowledge on ICT.



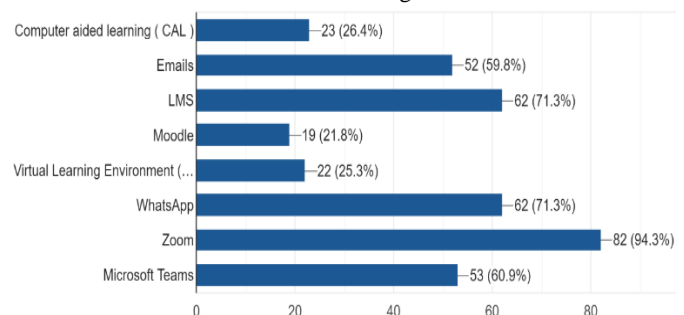
Source: Data collected survey

#### • Perceptions of the undergraduates upon E-learning

The third section focuses on the perceptions of the undergraduates upon E-learning. The perceptions of students about e-learning occupy a distinctive role in the sustainability of e-learning, notwithstanding all the efforts made by the government and the businesses that promote e-learning.

E-learning is preferred by 79% of students, while only 20% of students disagree. It also showed that, with 68% of the students shared that, laptops are the most popular device for processing e-learning, followed by mobile phones, tablets, and computers, respectively. 34% of the undergraduates claimed they used mobile data to access the internet, compared to 73% who indicated they used Wi-Fi. Only 5% of undergraduates reported using a dongle to access online learning, compared to 29% of those who use hotspot. 37% of respondents stated they use regular standard data, while 62% of respondents reported they utilize e-learning Wi-Fi and data bundles.

Chart 1- responses for What are the medias the undergraduates use for E – learning.

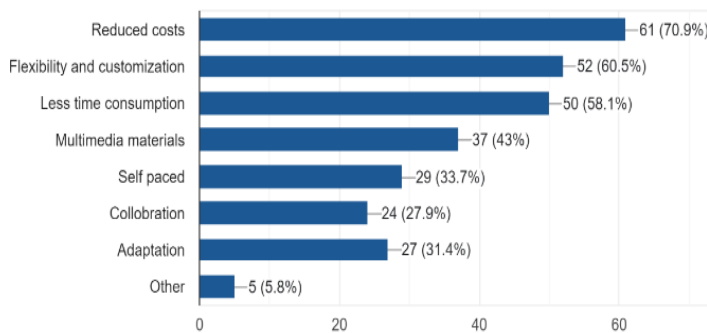


Source: Data collected survey

According to chart 1, it is possible to observe that Zoom is the mostly used E- learning platform whereas WhatsApp and LMS are the second mostly used medias to access E –

learning. Email is used by 52% which is closer to half of the responses received to the survey. Computer aided learning and virtual learning environment is used by 23% and 22% of the undergraduate population respectively. learning. The percentages of undergraduates who reported being satisfied and neutral with the university's internet services are nearly equal at 39% and 35%, respectively. Additionally, 10% and 11%, respectively, of respondents are highly satisfied and unsatisfied with the internet services offered by their universities. The findings show that only a few students are dissatisfied with the university internet facilities. While the least number of students who responded indicated that they are unsatisfied, and more than 50% of students believe their lecturers were successful in using e-teaching technologies.

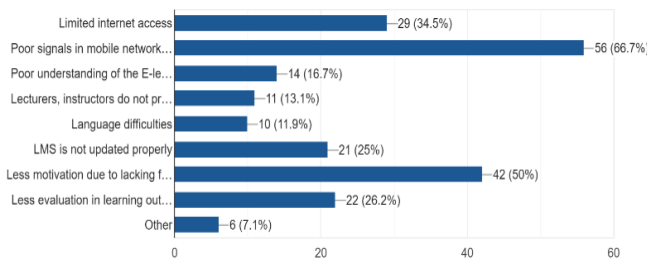
Chart 2 – Percentages of the advantages that undergraduates encountered in E – learning process.



Source: Data collected survey

It is possible to observe that undergraduates have voted for reduced costs as the major advantage in e – learning followed by flexibility and customization in E – learning platforms and less time consumption. Usage of multimedia materials, adaptability E – learning aiding self-paced learning, collaboration and adaptation can be illustrated as other advantages.

Chart 3 – Issues faced by undergraduates in E – learning



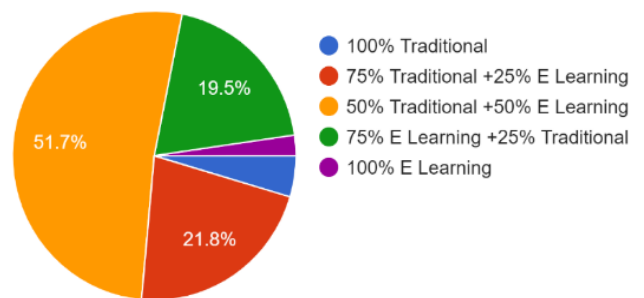
Source: Data collected survey

Poor signals in mobile network connection and less motivation due to the lack of face-to-face interaction seem to be the most frequently encountered issues in E learning. Less evaluation of the learning outcomes due to distance and LMS that is not properly updated properly are depicted

as other important issues to focus on alone with some other minor issues.

According to the data, the majority of students have suggested using online learning, and chart 4 below illustrates that more than 50% of students prefer using both online and face-to-face learning equally in their educational process. Additionally, the proportion of students who prefer a more conventional approach to education and a lesser amount of e-learning is roughly equal to the proportion of undergraduates who choose more e-learning and less traditional approach in their education. Least number of students prefer 100% E – learning method followed by 100% traditional method in learning.

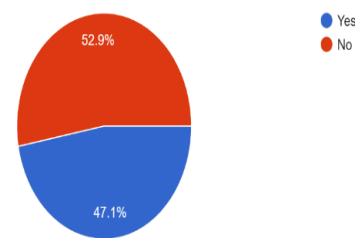
Chart 4 - Preferred combination of learning



Source: Data collected survey

C. Practices of the undergraduates on E Learning  
1) Experience in E-Learning before the Covid -19

Chart 1- Experience in E-Learning before the Covid -19



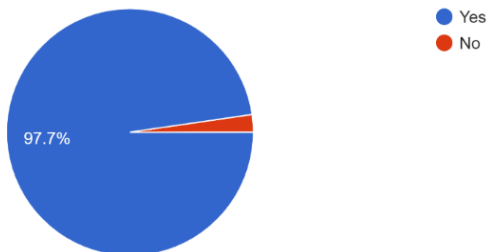
Source: Data collected survey

The purpose of this section is to explore the frequency of the undergraduate’s usage of online platforms prior and latter to the Pandemic. ;According to chart 1, it is observable that most of the undergraduates do not have experiences in using E-learning before the Covid-19 pandemic period. Out of (87) responses, (46) undergraduates, 52.9%; more than a half of respondents do not have experiences in E learning before the Covid-19

while (41) undergraduates ,47.1% have experiences in using E-learning before the Covid-19.

2) *Experience in E-Learning during the Covid -19*

Chart 2. Experience in E-Learning during the Covid -19

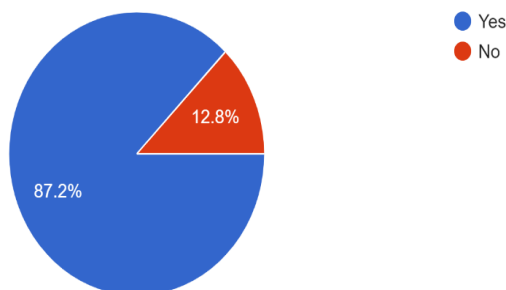


Source: Data collected survey

When comparing the responses percentage of chart 2 with the percentage of chart 1, there is an increasement of E-learners during the Covid-19 than before the pandemic and it is stated as 97.7% which is 85 undergraduates out of all the responded undergraduates (87) has used E-learning during the Covid period. Therefore, there is a least percentage of 2.3% or (2) undergraduates who has not used E-learning during the Covid-19.

3) *Are you still using E- learning even after the Covid-19?*

Chart 3. Are you still using E- learning even after the Covid-19?

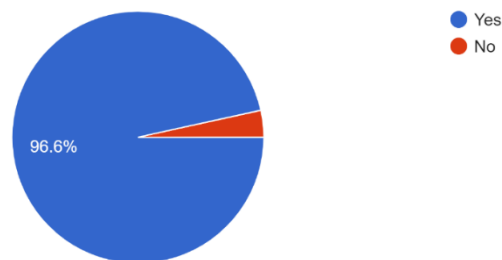


Source: Data collected survey

According to the chart 3, more than half of respondents, 87.2% (75) use E-learning even after the Covid-19. It is observable that there is a much improvement of using E-learning affected by the pandemic even after when comparing to the responses of chart 1; 47.1% and chart 2; 97.7% which is about the experiences of using E-learning before the Covid-19 and experiences of using E-learning during the Covid-19 respectively. Therefore, there is a least percentage of undergraduates as 12.8% (11) who do not use E-learning after the Covid-19.

4) *Did the pandemic's effects promote your E-learning?*

Chart 4. Did the pandemic's effects promote your E-learning?

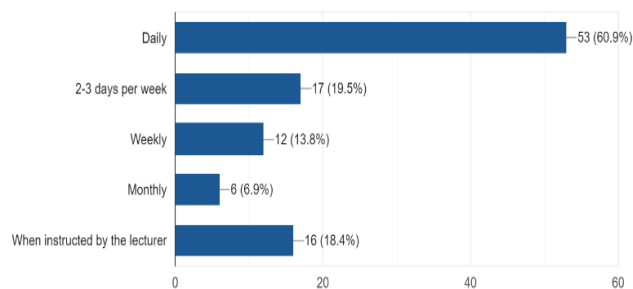


Source: Data collected survey

Most of the participants have stated that their E-learning has prompted with the pandemic and the percentages as followed, 96.6% (84) and 3.4% (3) do not agree that the pandemic has promoted their E-learning. Hence, most of the undergraduates agree that their E-learning has promoted with the Covid-19 pandemic situation.

5) *How often did you used E- learning before the Covid -19?*

Chart 5. How often did you used E- learning before the Covid -19?

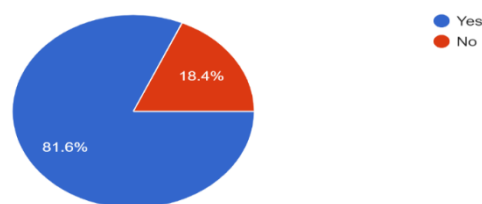


Source: Data collected survey

As for the percentages of responses, most of the participants tend to use E-learning when instructed by the lecturer before the Covid-19 and the percentage is 60.5% (49) out of all the respondents. The usages of 2-3 days per week, weekly and monthly were limited to percentages of 17.3% (14), 14.8% (12) and 13.6% (11) respectively. According to the chart, the daily E-learners are limited to 11.1% (9) before the Covid-19 period.

6) *How often did you used E- learning during the Covid -19?*

Chart 6. How often did you used E- learning during the Covid -



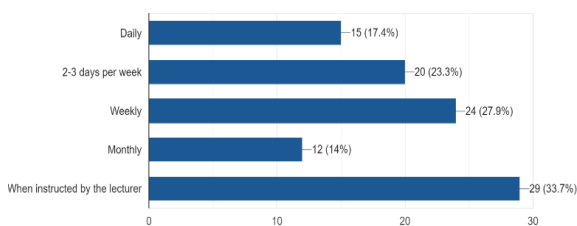
Source: Data collected survey



When comparing these percentages with the percentages of chart 5, it is observable that the daily E-learners have made an increasement during the Covid-19 period and it is stated as 60.9 % (53) out of all the respondents (87). The usages percentages of 2-3 days per week, weekly and when instructed by the lecturer as 19.5% (17), 13.8% (12) and 18.4% (16) respectively. In this chart, it is shown that there are least number of monthly E-learners, 6.9% (6) in the Covid-19 period.

7) *How often did you use E- learning after the Covid -19*

Chart 7. How often did you use E- learning after the Covid -19?

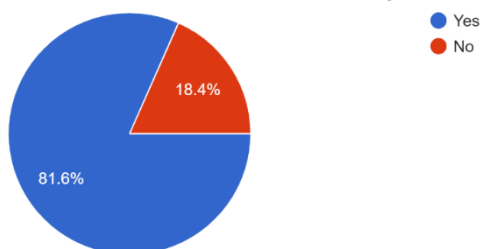


Source: Data collected survey

It is observable that after the pandemic, there is an increasement in all the mentioned usage constraints. But the responses show that most of the participants, 33.7% (29) use E-learning after the Covid-19 when they are instructed by the lecturer like in the chart 5 which is about the usage count of E-learning before the Covid-19. The usages of Daily, 2-3 days per week and weekly show percentages as 17.4% (15), 23.3% (20) and 27.9% (24) respectively. After the pandemic also, limited number of undergraduates, 14 % (12) are represented as monthly E-learners.

8) *Did E-learning packages of Data / Wi-Fi facilitate internet issues in E- learning?*

Chart 8. Did E-learning packages of Data / Wi-Fi facilitate internet issues in E- learning?



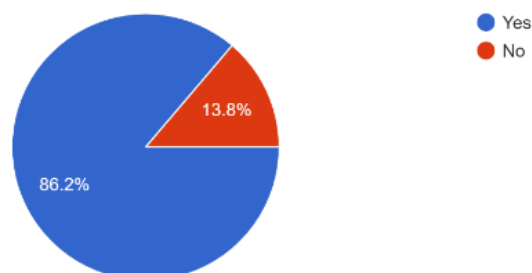
Source: Data collected survey

Most of the participants state that the E-learning data or Wi-Fi packages have facilitated internet issues in E-learning and the stated percentage is 81.6% (71) out of all

the responses. But limited number of participants, 18.4% (16) reveal that E -learning data or Wi-Fi packages have not facilitated internet issues in E-learning.

9) *Have permeant internet facility at home*

Chart 9. Have permeant internet facility at home



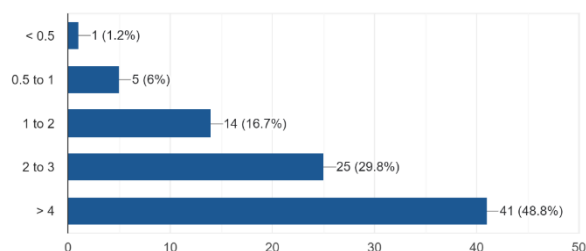
Source: Data collected survey

Chart 9 illustrates whether the participants have permeant internet facility at home. According to the chart, more than half of the all participants, 86.2% (75) state that they have permeant internet facility at home while limited number of participants, 13.8% (12) state that they do not have permeant internet facility at home.

10) *Internet surfing time (Hours)*

As stated in the chart, most of the participants, 48.8% (41) use internet for more than 4 hours. While around 29.8% (25) of participants use internet for 2 to 3 hours and 16.7% (14) participants use internet for 1 to 2 hours. And only 6% (5) participants use internet for 30 minutes to 1 hour. Only 1.2% (1) participant use internet for 30 minutes. The participants are questioned about their internet usage time period in hours in order to calculate how long they use internet. Following chart 10 demonstrates the time in hours that the participants use internet

Chart 10. Internet surfing time (Hours)



Source: Data collected survey

IV. DISCUSSION, RECOMMENDATIONS AND CONCLUSION

• *Discussion*

As in the second section, the survey results depict that most of the undergraduates are with the awareness of E – learning and that they have a moderate level of knowledge on ICT but it was obvious that most of them have not



received a formal training on using E – platforms for educational purposes prior to the university.

According to the third section, more than half of the students like E – learning whereas some students do not. Even the survey revealed that laptop is the most popular device to process e – learning, 32% of the students claimed that they use other devices which indicates the lack of laptops to process E – learning. As laptops are comparatively with more options, undergraduates may find E – learning, complex which can affect the sustainability of E – leaning. Also, it can be seen that most of the students face issues in internet connection problems and signal strength which can be linked with their internet accessing methods such as hotspot and data, as the signal strength can vary due to the weather. Also, even though the amount of standard data that consumes in E – learning can cost more than E- learning data bundles, the survey revealed that some of the undergraduates used standard data which illustrates the need for raising awareness about these specific data and Wi-Fi bundles. The usage of medias illustrated satisfiable results as the major E – learning platforms indicated a higher usage (zoom, LMS) which is beneficial for the sustainability of E – learning although the usage of computer aided learning showed a lower percentage. As some of the major issues in E – learning, connection issues and less motivation to learn due to lack of face-to-face interaction were indicated. Also, the survey revealed that E – learning tends to provide poor evaluation of learning outcomes which should be focused by the lecturers in the future for the sustainability of E – learning. The statistics show that more than half of the participants preferred equal rates of E – learning and traditional learning being applied in their learning process which indicates a positivity in the sustainability of E – learning. The reasons for the results can be reduced costs in printing, traveling and buying resources to learn, adaptability and flexibility which were highlighted from the survey.

The results of the fourth section shows that the usage of E – learning as increased by 50% during the covid – 19 epidemic period which indicated that the pandemic marked a turning point in digitalizing the learning process in the Sri Lankan universities. Even though after the pandemic the usage of E – learning has decreased by 10%, 30% of the undergraduates continued on using E – learning. The results also indicate the frequency of the usage of E – platforms increased to be daily in the pandemic. Also, a considerable number of students have stated that the E - learning Wi-Fi and data packages have facilitated them. Having no permanent internet facilities at home can be an issue to promote the sustainability of E – learning as mobile data can cause issues in the connectivity, due to weather changes. Also, as another important point, the usage of internet was indicated to be in a high rate, stating

that most of the students spend more than 4 hours surfing the internet.

#### • *Recommendations*

It is possible to recommend to provide students with opportunities to use E – learning and incorporate the use of electronic devices at the school from primary level, under observation and with limitations was revealed as a response to the open-ended question. Designing tailored interventions to encourage E-Learning adoption among all students might help with an understanding of the components affecting familiarity with it. The findings also imply that educational institutions and policymakers should keep funding and supporting projects in e-learning while also attending to the requirements of the minority population that is still inexperienced with these techniques. As laptops are comparatively with more options such as receiving documents sent to the zoom chat box, use of MS 365 easily, turning on camara, undergraduates may find E – learning, complex which can affect the sustainability of it. As a recommendation, the government and private sector, facilitating undergraduates with discounts to buy a laptop can be depicted. To promote computer aided learning, usage of computers in the school level for education, can be recommended. It is beneficial if the teachers are trained on task-based language teaching, interactive websites and activities that could be used in the lessons to address the issue of less motivation due to lack of interaction in online learning. Also, the teachers keeping the practice of updating the LMS in an efficient manner can also be depicted as a recommendation to higher up the usage of LMS. As in Sri Lanka, Google not being added in E – learning internet packages, can be seen as an issue to the sustainability of E – learning. It would be beneficial if there was an unlimited internet plan for surfing the internet as it is very much significant in promoting autonomous learning which was indicated in the answers to the open-ended questions. As other recommendations, providing basic learning materials such as quizzes, lecture notes, padlets, recordings, developing high-quality, interactive e-learning content that is engaging and relevant to learners and utilize multimedia elements such as videos, animations, and gamification techniques to enhance the learning experience can be illustrated as responds to the open-ended question.

#### • *Conclusion*

The study's results have demonstrated the feasibility of increasing and advancing the use of digitalization in education to provide students with a better educational experience during a pandemic or emergency period. The pupils' usage and understanding of utilizing digital gadgets were therefore on a reasonable level even before the outbreak, but their knowledge of their use was in a superior position. Having issues obtaining data through digital

devices and various internet access methods was one of the main difficulties. Furthermore, strong infrastructure, teacher preparation programs, and continuing technical assistance are needed investments to maintain sustainability. In order to continuously enhance and evolve digital education to satisfy the shifting demands of students and educators, collaborations between governments, educational institutions, and technology suppliers are essential for long-term success.

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# Teaching of Idiomatic Expressions in Teaching English as a second Language in Sri Lanka

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**Abstract**— *Idioms are one vital component every language around the world owns which entails an intended meaning behind them. Idioms and idiomaticity enable one to develop figurative competency, a component of communicative competency, which ultimately enables one to master overall language competency. Since there are different varieties of the English language, there are idioms from such varieties that can be used to identify the culture of the language and any hidden meanings. When teaching English as a second language (ESL), it is essential to expose the second language (L2) learners to such idioms from varieties of English. A corpus-based textbook analysis was done using the English grade 10 and 11 textbooks from the local syllabus in Sri Lanka to determine to what extent second language acquisition through idioms is supported by these texts. The findings indicate that idiom usage is very confined in English textbooks for grades 10 and 11, and that all those idioms that are included are of one specific variety—British English—and are not from different varieties. The study's findings unambiguously support the Sri Lankan L2 learners' minimal exposure to idiomaticity. This talk will highlight these findings and propose improvements that can be made to the syllabus to increase learner understanding of idioms.*

**Keywords**— **ESL, idioms, varieties of English, communicative competence**

## I. INTRODUCTION

Idioms are one vital component in every language around the world. Idiomatic expressions are phrases or groups of words with a meaning different from the literal interpretation of the individual words. They often carry a figurative or metaphorical meaning and are unique to a particular language or culture. Idioms have their origins deeply intertwined with a language's history, customs, and traditions. They hold a significant function in everyday dialogues, literature, and casual communication. (Blinova, 2021). Teaching idiomatic expressions in the context of teaching English as a second language is an important

aspect of language learning. Idioms add depth and richness to communication, allowing learners to sound more fluent and natural. Therefore, materials and content in textbooks of second language learners should incorporate idioms of varieties of English such as localized English, American English, Australian English...etc. In Sri Lankan context a good exposure to idiomaticity of varieties of English can greatly enhance students' language proficiency and cultural understanding (Bouherar, 2017). Therefore, incorporating them into language lessons can help students develop more natural and fluent (Maisa et al 2013), communication competency.

## II. IMPORTANCE OF STUDY

Teaching idiomatic expressions is significant in the context of teaching English as a second language and language learning, as it directly contributes to the developing communicative competence; the ability to use and comprehend language effectively and appropriately in various social and cultural contexts. It encompasses not only the grammatical and lexical aspects of language but also understanding and using language in context. Idiomatic expressions, which are phrases or sentences that have a meaning beyond the literal interpretation, are an integral part of authentic language use. The second language learners in the context of English language education needs to be exposed to idiomaticity from different varieties of English not just one exact variety. The exposure they get will benefit them in various ways. Learners who are familiar with idiomatic expressions often can better comprehend and respond to authentic language in context. By teaching idioms, learners gain insight into cultural background and context in which the language is used. This understanding enhances their ability to communicate in an effective way with both native and non-native speakers and interpret language in its cultural context.

Several studies have been conducted on the area of idiomaticity in several countries in the context of second language teaching and language learning.

A study conducted by Blinova et al (2021) on idiomaticity sheds lights on an “idiomatic paradox”, where, native speakers in speaking discourse cling on to idioms while even advanced learners find it hard to comprehend and decode the meaning behind them (Prodromou, 2003 cited in Blinova et. Al., 2021). This study discusses why idioms present difficulties for learners and the common difficulties that the learners face in the presence of idioms (Blinova et al., 2021).

Another corpus-based study conducted on idiomaticity by Rafatbakhsh & Ahmadi (2019), explores a more effective approach to teaching and learning idioms by categorizing them based on their common themes and topics. The traditional method of teaching idioms usually relies on the judgement of teachers or materials writers, often on an individual basis. To address this, the study utilizes corpus linguistics, specifically the Corpus of Contemporary American English (COCA), which is a large and freely available collection of texts, aiming to design and develop more authentic and systematic teaching materials for idioms using comprehensive corpora, as they provide the best representation of the target language. The study employs a manuscript written by a professional computer programmer, specifically created for this purpose. The researchers searched for the thematic index of 1506 idioms under 81 categories at the end of the Oxford Dictionary of Idioms. They then used the COCA corpus, which consists of over 520 million words, to analyze the idioms and determine their frequencies within their respective theme-based categories. The findings of the study resulted in a list of idioms sorted by their frequencies under specific thematic categories. This list can be used by materials designers, teachers, and learners of English to focus on the more frequently used idioms in real contexts. It can serve as a valuable resource for incorporating idioms into textbooks and designing engaging classroom activities centered around idiomatic expressions (Rafatbakhsh & Ahmadi, 2019).

The study conducted by Callies (2017) explores the culture-specific aspects of figurative language, specifically idioms, in different varieties of English. The paper examines idiomatic expressions related food and eating in various English varieties, particularly focusing on (West) African Englishes. This study suggests that idioms are conceptually motivated by underlying metaphorical mappings and reflect the intersection of language and culture. By analyzing data from large-scale web corpora, the paper investigates the lexico-grammatical and conceptual variations in selected food and eating idioms. The findings reveal patterns of lexico-grammatical variation and innovation in idiomatic expressions in West African Englishes. The research confirms previous studies that highlight the significance and frequency of food and

eating-related concepts as source domains in conceptual metaphorical mappings within West African cultures (Callies, 2017).

Although several studies have been conducted on idiomaticity around the world, the lack of research focused on this area, particularly in Sri Lankan context, is evident. It is crucial to draw necessary attention to this area since idiomaticity enhances one’s language competence. Therefore, this study sheds lights on to the importance of teaching of idiomatic expressions in teaching English as a second language in Sri Lanka.

The study aims to address the following question.

- To what extent the English as a second language acquisition through idioms is supported by the grade 10 and 11 textbooks of local syllabus in Sri Lanka.

#### IV. METHODOLOGY

To conduct the corpus based textbook analysis, particularly to analyse the use of idiomatic language in grades 10 and 11 English pupils' books, the computer-based software; LancsBox is used. As the main objective of this research, is to identify the frequency of idiomatic language and to ensure the textbooks represent and cover a range of topics relevant to idiomatic language that are used in grade 10 and 11 English textbooks, the soft copies of the textbooks are imported into Lancsbox, ensuring each book is treated as a separate document. Then pre-processed the texts to prepare them for analysis by applying necessary pre-processing steps and customized the pre-processing settings based on the textbook analysis requirements. As the next step specified the analysis features the idiomatic language and sets up specific parameters related to idiomatic languages. Next functioned the additional settings to analyse the frequency of idiomatic language and run the analysis. Finally, the software processed the texts and generated the results based on the criteria included in the Lancsbox.

#### V. FINDINGS

According to the textbook analysis results, there was only one activity in the grade 10 English pupils’ book and one activity in the grade 11 English pupils’ book on idioms. Idioms were used only in the eleventh activity of the fourth chapter (Let’s Talk) of the grade 10 textbook and, in the thirteenth activity of the fifth chapter (Best use of time) of the year 11 textbook. Both in the grade 10 and 11 English textbooks, there were only two activities to match the idioms with the meanings. Moreover, these activities were just isolated without any contexts in which they had been used. Based on the analysis there were not any lessons related to idioms. The aim of this analysis was to find out to what extent the idiomatic language has been used in grade 10 and 11 English textbooks. The results show that a

very limited exposure to idiomatic language has been provided, and the idiomatic language used in the textbook is not from different varieties of English but just only British English. Moreover, the results show the zero amount of example provided to demonstrate how these idioms are used in real language contexts.

#### .VI. SUGGESTIONS

The grade 10 and 11 English textbooks from Sri Lanka local syllabus need to incorporate more lessons that include idiomatic expressions from varieties of English and make sure the books include localized Sri Lankan varieties as well since the Sri Lankan learners are already familiar with localized idioms. The activities based on idioms need to be followed by examples where the learners get exposed to how idioms are used in real life contexts.

#### VIII. DISCUSSION

The English textbooks of grade 10 and 11 of Sri Lanka gives limited exposure of idioms of English to the second language learners. The limited idioms mentioned in the two books are from British English only. No other variations of idioms in English such as localized variations, American English, Australian English...etc. seem to be mentioned alongside the British English. Moreover, the second language learners are not exposed to how those idioms are used in real life context since there is no lessons with examples and passage, dialogues, and contexts in these two books in which idioms are used. This limited exposure to idioms may obstruct the learner's communicative competency in real life since they are not exposed to idioms from varieties of English. When communicative competency is hindered with limited exposure the learner may struggle in real life language situations by not being able to decode the discourse, hidden meaning, intended meaning.

#### VII. CONCLUSION

The corpus based textbook analysis which was conducted using the English grade 10 and 11 textbooks from local syllabus in Sri Lanka to determine to what extent second language acquisition through idioms is supported by these texts, demonstrate the limited exposure that the second language learners have been provided. The limited exposure of idioms, particularly the idioms from varieties of English may result in the obstruction of the communicative competence of the second language learners. Therefore, these textbooks should take measures to approach this issue in a way that is effective. The local English textbooks should incorporate idioms from varieties of English, not just, one variety of English alongside the textbooks need to include idioms not separately but how it is used in authentic contexts using real life examples.

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# Factors to Consider: Promoting Speaking Competence of National Languages of Sri Lanka

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**Abstract-** Incompetency of verbal communication in national languages is a national-level problem in Sri Lanka when the two main language groups do not use a common language or when the citizens do not know both national languages of the country. In that context, the objective of this research is to identify the factors that hinder verbal communication between two linguistic communities in Sri Lanka, Sinhala and Tamil, and to explore the factors that can motivate the process of improving the number of speakers who are competent in Sinhala and Tamil. The aim is to facilitate harmonious co-existence among ethnicities and to increase the intercultural understanding for peaceful reconciliation in Sri Lanka. The explorative study adhered to the inductive reasoning approach. Based on the cross-sectional sampling method, 09 professionals constantly involved in verbal communication were selected, representing government and non-government institutes. The sample was collected from four provinces, particularly regarding the highest density of the multiethnic community in Sri Lanka. Interview-based qualitative data were analyzed and presented through thematic analysis followed by the themes that illustrate the aspects of educational, political, cultural, and professional. The findings suggested closely monitoring the policies and practices related to national language learning, using career advancement strategies for language learning motivation and conducting mandatory language development programmes for Sinhala and Tamil and implementing them for primary, secondary and tertiary education to build verbal communication among people to link people from different linguistic groups.

Keywords: *Speaking Competency, National Languages, language education, harmonious co-existence, reconciliation in Sri Lanka*

## I. INTRODUCTION

Sri Lanka, an island situated at the southern tip of India, comprises two major ethnic groups; Sinhala and Tamil, who are inhabitants of the island for centuries (Wyss, 2020). Based on "language, religion, ethnic origin, culture, and ancestral territory," each ethnic group has established a

distinct and strong identity (Kearney1978; Herath, 2015, pp.246). However, due to the different Language usage in communication among the ethnicities: there is a language barrier among ethnic groups in Sri Lanka in terms of communication and understanding, which led to the language bill of 1956, the massacre of 13 Sri Lankan soldiers in 1983 and the Black July incident led to the 30-year armed conflict between the Sinhalese-drove government and the LTTE (Liberation Tigers of Tamil Eelam 2004) in Sri Lanka (Imtiyaz, 2008). The presentation of linguistic arrangements that created divisions along ethnic and phonetic lines, which ignited the war, contributed to the conflict's leading cause. As evidence for the following cause of the conflict, a former militant of the conflict, and present member of the Tamil National Alliance political party, Suresh Premachandran, stated that, "This has been a historical grievance. Though one of the national languages, the Tamil language's applicability has been largely confined to the areas where Tamil-speaking people are the majority," (OCHA, 2012) In addition, the Table 1 presents the recent statistics of language skills of Sri Lankans.

Table 1-Speaking Competency (Age 10 years and above) by ethnicity - 2019

Ethnic group	Population aged 10 years & over	Ability to Speak		
		Sinhala	Tamil	English
Sinhalese	12,764,681	12,701,932	812,738	3,033,659
Sri Lanka Tamil	1,871,960	614,169	1,835,657	390,676
Indian Tamil	671,378	412,685	664,541	87,435
Muslim	1,467,956	862,397	1,442,875	446,146
Malay	36,567	34,899	28,975	24,202
Burgher	33,170	29,277	12,738	24,412
Other	22,113	14,880	10,060	13,053

Source :Department of Census and Statistics, 2019

Table 2-Speaking Competency (Age 10 years and above) by population Sectors - 2019

Population Sectors	Population aged 10 years & over	Ability to Speak		
		Sinhala	Tamil	English
All	16,867,825	14,670,239	4,807,584	4,019,583
Urban	3,130,283	2,665,689	1,294,442	1,381,251
Rural	13,021,416	11,540,351	2,853,275	2,566,240

Source :Department of Census and Statistics, 2019

According to the statistical records of national statistics, English, the link language of Sri Lanka, is higher than Tamil usage. Even though Sinhala and Tamil are the two national languages of the country, the use of one national language is superseded by the link language. However, the statistics also reveal English, the link language, is not spoken by most of the country and is identified as a disturbing factor for interethnic communication, which is integral for peaceful co-existence.

### II. Research Problem

Sri Lanka, an island which was baffled by "30 years of inter-state level conflict, due to main three matters of identity, which have been the most common causes of conflict, unrest, and violence in Sri Lanka—religion, ethnicity, and language" (Soherwordi, 2010, pp. 29-49). Language barrier is a national-level issue in Sri Lanka regarding interethnic communication and understanding among different ethnicities; it is acknowledged to be a crucial component in ethnocentric conflicts. Therefore, it is believed that "Ensuring language parity is as important as resettlement and rehabilitation" (UNHCR, The UN Refugee Agency, 2012), by increasing the competence of verbal communication in both national languages among main ethnic communities. Further, it is believed that making them mindful of verbal correspondence on both public dialects among networks would be an instrument for a more noteworthy reconciliation (OCHA, 2012).

### III. Research Objectives

The primary objective of this study is to identify the factors that hinder verbal communication between two linguistic communities in Sri Lanka, Sinhala and Tamil, and to explore the factors that can motivate the process of improving the number of speakers who are competent in Sinhala and Tamil.

- To identify the recommendations and suggestions commended by the experienced professionals to develop speaking competence in the national languages of Sri Lanka.
- To explore the factors that hinder the learning of both national languages through the experience and

viewpoints of individuals who are already competent in both national languages of Sri Lanka.

- To investigate their positive experience and demonstrate their language competence to foster reconciliation.

## IV. METHODOLOGY

### Research Design

This exploratory research was carried out through 09 focus group interviews. Qualitative data was gathered, and the responses were analyzed and presented in thematic analysis. Bennett's Developmental of Intercultural Sensitivity (DIMS) model provides the theoretical reflection to this study. Due to the Covid-19 pandemic and the prevailing travel restrictions during the research data collecting period, the interviews were conducted as a virtual and one face-to-face physical interview. The sample population was 08 individuals and a representative from the society, a businessman. The sample population contains individuals from both the public and private sectors. Through the interviews, personal opinions and suggestions were collected. Each interviewee was given a customized questionnaire according to their designation. More emphasis was given to predominantly homogeneous provinces with most speakers of one national language.

Table 3. Sample: the listed interviewee

Designation	Location
Brigadier/ Director multipurpose development task force	Western Province
Turkish Red Cross representative	Northern and Eastern provinces
Police officer	Northern province
Police officer	Western Province
Teacher of Tamil Language	Western Province
General Public (Corporate Representative)	Northern province
General Public (Corporate Representative)	Northern province
General Public (Sinhalese individual living in Jaffna, businessman)	Northern province
General Public (Tamil individuals living in Mathara)	Southern province

Table 3 demonstrates the individuals in the sample who have large-scale public relations and constant engagement in social activities recognized by the State. The basic rationale for selecting the sample population was their frequent social interaction and vocal communication ability. Some individuals are state officials for specific specified social roles and activities. For example, 'the Turkish Red Cross representative acts as the liaison



between the Red Cross and Sri Lanka, where he conducts social projects in the Northern and Eastern provinces. Therefore, he/she must have the ability to communicate appropriately, to get accurate data and information from village civilians for administrative purposes. The Academic and the Teacher were essential for this research because they teach students from various language backgrounds, where they confront the communication issue. Businessmen/Corporate representatives were also selected since they handle different communities where language communication plays a massive role in business interaction.

Further, the Police Officer and the representative from the general public were two other individuals who belonged to this category, representing communication with society. Further, the four public members were added to the sample to inquire about their opinions about the research topic. Therefore, the following selected population is the most suitable to address the research issue. Two provincial locations were selected to gather the sample population: a homogenous- single ethnic community-based province, while one heterogeneous-multiethnic- community. This is to ensure and receive accurate data and information, as well as different opinions and views based on regional influence.

#### *Data Collection Methods and Tools*

This study conducted semi-structured interviews with participants to gather qualitative data. To ensure accuracy and capture the notes of the interviews, audio recordings were used in conjunction with notetaking during each session. All participants provided informed consent for audio recordings. The reason for selecting semi-structured interviews was to provide a balance between structure and flexibility for the interviewee, which helped us create a set of predetermined questions while also allowing for spontaneous follow-up questions with the interviewee, which enabled us to gain an in-depth exploration of participants' responses, leading to richer data. Further, the semi-structured interviews helped us to gain richer qualitative data, which allowed interviewees to share their thoughts, experiences, and perspectives in their own words, leading the results in rich qualitative data that can capture nuances, emotions, and complexities that might not be easily captured through quantitative methods. Finally, to gain a contextual understanding, which allowed us to delve into the contextual factors surrounding interviewees' experiences. This helped us interpret and understand participants' responses in a broader social, cultural, or personal context. Accordingly, we added nine questions, which covered the areas of their career expertise, career background, experiences, knowledge and relevancy to the research topic. Following the qualitative data handling practices, the anonymity of the data was maintained. The

respondents' professional positions were only used to identify the respondent, the names were not revealed. They were informed about it and made the respondents confident about the information they provided, which was an added quality to ensure high-quality qualitative data.

The questions for the interviews were formed in accordance with the research objectives. The questionnaire validity was tested based on face validity. Translators were used to translate on certain occasions of the interviews in terms of having efficient communication. In terms of interview procedures, the interview time duration was based on the interviewees' responses. For instance, four of the interviewees, which were the Director of the multipurpose development task force during the research period, the Turkish Red Cross representative of North and East provinces and the two Police officers from North and West provinces had one hour of interview time duration, while the rest of the interviews had a time duration of half an hour.

#### *Ethical Considerations*

This topic covers a controversial and ethnically sensitive topic. Department-level ethical permission was given to conduct this research for the partial fulfilment of the Bachelor of Science Degree. Formal consent was obtained from all the participants in the data collection process through a consent form. The study was completed avoiding the possibility of any ethical harm to human participants involved. The study was also conducted in such a manner as to protect anonymity and confidentiality, avoiding deceptive practices and providing the right to withdraw. Therefore, research participants were pre-notified. The online recordings were not published elsewhere.

## V. RESULTS & DISCUSSION

As per the thematic analysis method, five themes emerged through the data gathered. These were classified as follows,

1. Benefits of bilingual speaking skills
2. Political Aspect: Influence of political aspect
3. Educational Aspect: From the point of view of education
4. Professional Aspect: Experience and requirements in the professional aspect
5. Cultural Aspect: Impact on culture on language and vice versa

Findings are presented according to five themes.

### *1. Benefits of bilingual speaking skills*

This section mainly presents the reasons found from the selected research sample for developing speaking skills in national languages in Sri Lanka. Most respondents agreed that learning both national languages has given them an

added advantage while living in Sri Lanka. This includes the various professions the respondents are engaged in.

“An added advantage when working in Northern and Eastern Province, especially for civil

(By the respondent – Police Officer- Colombo)

Further, a similar idea was given by a representative member from the armed forces, who is on duty in the Northern and Eastern provinces, who stated the importance of learning a second language to improve communication between the residents. For him, the second national language is Tamil. Learning a Second national language has also brought economic advantages to some respondents by making it their career to teach the second national language.

“I’m Sinhalese but I learnt Tamil, Economic benefits and the ability to teach Tamil to Sinhalese for Sinhala children.”

(The respondent- The teacher who teaches Tamil, based in the Western Province)

The respondents have also stated that learning the second national language has reduced the cultural gap in between the two communities. Thus, according to the responses given by the sample population, it is clear that learning the two national languages bring added advantage to their lives in different ways. Moreover, learning a second language extends their communication capacities while enhancing the possibility of speaking to any Sri Lankan citizen irrespective of their ethnic or language group. Consequently, this is the common and one of the best methods to improve mutual understanding between communities where two languages are used.

As per the data gathered, the preference for national languages other than a lingua franca is essential here due to the attitudinal changes and as well as for the 'acceptance of the other language group'. The selected sample of respondents shared their ideas and experiences of being actively engaged in verbal communication using both national languages in a society where two different languages are in use. Therefore, it is presented in the model that ethnic relativism, which is the turning point, begins from 'Acceptance'. It is the acceptance to learn the other national language, i.e. Tamil for Sinhalese and Sinhala for Tamils. Accordingly, we observe this move as a positive move, a peace-friendly change that facilitates the reconciliation process in the country.

- Political Aspect: Influence of political aspect

Regarding political aspects, most interviewees suggested strengthening the constitutional amendments of language communication and recognition of the national languages. In terms of educational elements, all the respondents (100%) expressed that the present education system is not efficient and supportive in increasing the speaking competency of the national languages of Sri Lanka. According to our findings based on our interviewees' respondents, the population gap plays a huge role in the hindrance due to the majority and minority thoughts and attitudes towards each other, for instance,

“Majority community has to accept cultural differences, Eradicating Sinhalese Chauvinism. Initiate the LLRC and Maxwell Paranagama Report” based on the interviewee Turkish Red Cross Representatives response.”

(Turkish Red Cross Representative)

Regarding cultural aspects, respondents have shown that increasing competency of speaking skills in two national languages is essential for the reconciliation in different ways. It is also the first step in understanding the culture of the two communities in the sample population. It has also pointed out that learning the alternative national language helps eradicate interethnic hostilities between the two communities. To quote the respondent's words,

“We can't understand a culture of a particular region, by just understanding a speaking competency. to increase the competency in all aspects of communication and develop cultural meritocracy but it helps in developing the acceptance and intercultural understanding”.

(By the Respondent Tamil Teacher)

Furthermore, racial superiority between the ethnicities in the country is also known to be another critical preventive factor. Further, according to the respondents, lack of opportunities to learn the alternative national language or improve speaking competency are commonly found as critical barriers. Also, lack of exposure towards learning both national languages, at least achieving speaking competency, is prevalent. As per the data gathered, it was due to families' lack of encouragement or motivation to learn the alternative national languages. Particularly, as per the opinions shared by the respondents, most of the parents do not see their children getting any educational or career-related advantage of learning both national languages. Their preference was to learn English rather than learning the alternative national language. Further, they highlighted the parents' preference to spend extra time learning English but not on the alternative national language. Moreover, they added that this condition may be used on the economic and social factors of families, as well as the

parents' lack of broader knowledge of learning both national languages and limited personal contact with the members of other communities where they feel there is no requirement or need to learn the alternative national language. Thus, two major implied ideas are derived. One is the necessity of promotional campaigns to educate the general public about the advantages of learning both the national language. The other is the need of adequate benefits to encourage students and parents to learn both national languages from educational and career perspectives.

- Educational Aspect: From the point of view of education

All the respondents have agreed that the present education system is not efficient in increasing the speaking competence of the national languages of Sri Lanka. Respondents have shown that the lack of educational competencies throughout all the educational levels in learning is the main reason for such hindrance. For example, in the current educational system, priority is not given to the improvement of Tamil and Sinhala speaking skills. The individual's intention to get a Credit pass in the General Certificate Examination (Ordinary Level) and lack of attention to Tamil language speaking competence curriculum in schools. Further, even though there were certain curricular subjects, certain limited time periods were allocated for the specific subject based on the interviewees' school experience back then. Further, according to subject experts, school textbooks mainly promote written language, focusing less on the speaking aspect of the language.

“speaking Tamil, is not based upon pure speaking Sri Lankan Tamil language (Speaking Dialects based on regional area of the Northern and Eastern Province), for the textbooks were based on only one aspect, which is the writing aspect”

(The teacher who teaches Tamil, based in the Western Province),

These are the difficulties for teachers to teach students in improving Tamil language speaking competency. Therefore, educational hindrances are major preventive factors for furthering national-level recommendations and implementations. Furthermore, Educational tutors, and the majority of government language teachers (Sinhala and Tamil) have stressed that there are inadequate number of teachers, especially in the north and east parts of the country, to teach the second language i.e., Sinhala.

"Lack of Sinhala teachers. Only 3 teachers are there. People make an effort to learn however, it is not possible as there are not enough teachers to teach". Therefore, the issues should be addressed in a national level, by raising awareness and call-upon action for the Ministry of Education towards the issue."

(According to the teacher who teaches Tamil, based in the Western Province),

Textbooks were based on only one aspect, which is the writing aspect. These are the difficulties for teachers to teach students in improving Tamil language speaking competency. Therefore, educational hindrances are major preventive factors for furthering national-level recommendations and implementations. Furthermore, Educational tutors, and the majority of government language teachers (Sinhala and Tamil) have stressed that there are inadequate numbers of teachers, especially in the north and east parts of the country, to teach the second language, i.e., Sinhala.

Moreover, racial superiority between the ethnicities in the country is also known to be another critical preventive factor. Further, lack of opportunities to learn the alternative national language and fewer options and motivation to improve speaking competency of both national languages are also commonly found critical barriers according to the respondents. Also, lack of exposure towards learning the speaking competency of a second language is mainly due to parents' discouragement or not prioritizing it for their children due to surrounding economic and social factors of families, as well as a particular effect on minimum interaction with diverse community friends among them. Incompetent bilingual language competency, as well as some of the Sinhalese interviewees, are not competent in Tamil language speaking competency. Therefore, such factors are known to be preventive towards national-level recommendations and implementations.

- Professional Aspect: Experience and requirements in the professional aspect

In terms of career aspects, respondents have expressed the importance of learning the alternative national language based on their different professions,

“Now living alone in Jaffna, where there aren't many Sinhalese here, but by learning the Tamil language, it helped me to understand the Tamil culture and change my opinion about the Tamil population”.

(By the representative general public member, a Sinhalese living in Jaffna).

The sample population contains individuals from the public and private sectors, so they have identified the importance of learning national languages. The two police officers interviewed stated that learning the two national languages is necessary while on duty in the North and East. His words are quoted below.

“Yes, as a police officer, it is an important tool to be useful by doing service in the North and East”.

( By the respondent Police officer).

- Cultural Aspect: Impact on culture on language and vice versa

Respondents have shown that increasing competency in speaking skills is essential for the reconciliation from different aspects. Some have pointed out that it is a key requirement for various job opportunities in the Northern and Eastern provinces. The sample has also pointed out that it effectively improves communal understanding and develops respect between the two communities. It is also the first step in understanding the two communities' cultures. The sample population has also pointed out that learning national languages helps eradicate intercultural hostilities between the two communities. This is seen from the responses of the three public members, who stated that their preconceived negative perceptions of other communities were diminished after learning the second language.

“Now living alone in Jaffna, where there aren't many Sinhalese here, but by learning the Tamil language it helped me to understand the Tamil culture and change my opinion about the Tamil population”.

(By the representative general public member, Sinhalese living in Jaffna)

Similar ideas were given by the general public member (representing corporate representative) selected from the Tamil ethnicity background,

“As Tamils especially during the war, we had a completely different idea about the Sinhalese community, but after I came to Colombo in 2008, I learned the Sinhalese language and all my prior perspectives of the Sinhalese community changed. They were kind-hearted and helpful. This was a life changing opportunity for me as I experienced the openness of the Sinhalese community”.

(By the respondent, general public member, corporate representative Jaffna)

Furthermore, some respondents have argued that culture does not directly connect with speaking competency. However, they have agreed that increasing speaking competency can help the two communities improve the intercommunication between them.

“Experience by serving in the Batticaloa region, didn't even understand the language, therefore language understanding before cultural understanding for an effective community understanding”.

(By the Respondent Police Officer, Northern province).

## VI. DISCUSSION

Accordingly, the summary of the findings is presented as follows. The first point is that all the interviewees believe that achieving a second national language competency is an advantage and an added advantage for the future reconciliation process. Secondly, the interviewees expressed that social institutions and racial superiority play a massive role in improving speaking a second national language. However, there was a disparity of the ideas based upon the opinions; 75% of the interviewees pointed out that learning both national languages is crucial in understanding the alternative ethnic communities, while 25% of interviewees pointed out that speaking competency is not required.

Further, findings show that educational factors such as making both national languages compulsory and increasing and follow-up parent-student motivation are promotional factors to learning both national languages. Similarly, the data showed that the absence of such motivations hinders the respondents' potential and tendency to learn both national languages, at least the speaking competence. Almost all the respondents agreed that the present education system does not provide the necessary background for students to learn and develop speaking competency in both national languages. They pointed out various factors that hinder the learning of both national languages, such as inadequate teacher allocations, the subject is not considered 'very important' in competitive exams at the school level, both national languages are not compulsory for primary, secondary or tertiary level of education, the second language is only taught up to grade 11 in the school curriculum, not educating about the benefits of learning both national languages and absence of any motivative factor to learn both national languages. Moreover, the respondents pointed out the fact that the school syllabus is only based on the reading and writing aspects of language learning. Finally, they also stated that, though they are interested in learning the second national language, there is teacher scarcity, especially among Sinhala teachers in the Northern province. There were

slightly related answers for improving the speaking competency of a second national language to eradicate the unity gap among communities, which was based on the suggestions Cross Representative, 'LLRC and Maxwell Paranagama Report suggestions' were well related to the suggestions and recommendations for the research problem, for most of the suggestions were based upon the State and Government's role in implementation. The eighth question, towards the research problem. As per the Turkish Red which was based on the experiences of the respondents and their usage of the second national language, suggests that learning both national languages plays an integral role in the communication aspect of the workplaces of the interviewees. It seems that it is common in Governmental organizations and institutes as well as Non-Governmental Organizations, to use one language throughout the workshop or meetings, whether they initiated the workshop in link language or using both languages. All the interviewees mentioned that translators were required to fulfil duties and responsibilities in their use of communication in the alternative national language, Tamil or Sinhala. Considering the theoretical aspect related to communication for the reconciliation process, Bennet's DIMS Model, the transition from Denial to Integration takes place if the communication prevails only. Finally, upon the reconciliation efforts, all interviewees agreed with the fact that national languages play a huge role in the peace-building and reconciliation effort; even though many of them were not much aware of the greater benefits or long-term benefits of national reconciliation, many of them have realized the need of the daily necessities of people to use both national language speaking competence when they interact with the society.

## VII. CONCLUSION

This study evaluates the factors to consider: promoting speaking competence in both national languages of Sri Lanka. This study was conducted to achieve one main research objective and two specific objectives. Each of the specific objectives directly impacts enhancing the speaking competence of both national languages of Sri Lanka. The research was conducted on context-based analysis of the responses of the research participants.

The interviewees have experienced the research problem due to their career and social background in Sri Lanka. The information gathered from the interviewees was based on their daily experience and knowledge of using both national languages, with particular concern towards speaking competence. The findings provided a clear path to enhance the efficiency and effectiveness of the factors to promote speaking competence in both national languages of Sri Lanka.

The research findings were analyzed through content analysis, and each theme provided specific factors. The majority of the interviewees' statements relate to the issues in the educational sector, which are derived from the secondary school educational system. In addition, schools and universities are suggested to be the most effective learning places for individuals where the majority prefer to teach both national languages and speaking competencies mandatory. The respondents believe that it is effective to build the process by teaching the speaking competency of national languages, further strengthening the efforts.

Furthermore, in terms of cultural and ethnicity-related aspects, lack of respect among inter-cultures and ethnicities is identified as a major barrier in implementing the speaking competency programs among the ethnicities. Thereby, based on the findings, through social blending, educating on interethnic/intercultural respect and the increase of diversity inclusion may lead to an effective mechanism for the reconciliation efforts. According to most interviewees, once a person accepts that there is a difference and acknowledges it, then the process of integration becomes easy. Therefore, mutual respect must be maintained among the ethnicities, which will give a main incentive towards learning speaking competencies of national languages cross-culturally and communities Vice Versa.

In terms of the professional aspect, another major driving incentive towards the increase of speaking competency is promoting the speaking competence of both national languages via job recruitments and increased intensity of career-related promotions. Most individuals fulfil specific qualifications or requirements to achieve their career or labour goals but do not bother to continue language competence there. Therefore, through this aspect, effective follow-up programmes and introducing incentives on improving both the national languages, at least the speaking competency programmes, can be identified as motivational factors cooperating with the employer aspect. For instance, according to interviewees who are in the public sector, the Department of National Languages in Sri Lanka conducts National Language written exams to implement an effective government administrative method (Department of Official Languages, 2023) (Not allowing individuals to be appointed for higher level positions if failure to build both National languages competency in the writing aspect). To strengthen the aspect, added salary bonuses, promotions and recognition towards the employees are identified as further motivational factors to improve speaking competency in both national languages. Therefore, with the above implications, the scope of this study is narrowed down to five factors: benefits of bilingual speaking skills, political, cultural, educational and professional. Therefore, it is proposed to enhance the

following suggestions and recommendations raised by the research outcome based on the first-hand experience of the interviewees and the theoretical models based on the field.

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# Investigating the Features of Academic Writing in Research among Undergraduates

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**Abstract**— *In academic settings, academic writing is a specialized style of writing that adheres to specific rules and guidelines. As noted by Smith (2019), it is characterized by a formal and unbiased tone, precise terminology, and adherence to established norms. This study aims to explore two aspects of academic writing: the use of hedging and the frequency of personal pronouns. To facilitate future research, a mini-corpus called the "Academic Writing in Research Corpus" (AWRC) is introduced. This corpus will serve as a valuable resource for investigating the patterns and tendencies related to hedging and the use of personal pronouns in academic writing. By exploring these aspects, the study aims to contribute to a deeper understanding of the linguistic characteristics of academic writing, providing insights into the ways in which authors employ hedging strategies and the role of personal pronouns in scholarly discourse. The findings will contribute to future research endeavors in this area. The study focuses on undergraduates from the Faculty of Law at General Sir John Kotelawala Defense University. The research design involves collecting proposal writings from this group as representative samples. The collected data will be processed and analyzed to quantify the frequency of hedging and personal pronoun usage. A comparative analysis will be conducted to compare these usage patterns across different proposals. Statistical techniques may be used to determine the significance of any observed differences. This research design will provide valuable insights into the frequency and patterns of hedging and personal pronouns in research writing by undergraduate students.*

**Keywords**— Academic - Writing, Research, AWRC

## I. INTRODUCTION

Academic writing plays a vital role in the generation and dissemination of knowledge, and researchers employ various strategies to enhance the effectiveness and clarity of their work. This comparative research delves into the utilization of corpora in academic research and explores how different studies approach the use of hedging and personal pronouns. The objective of this research is to shed light on the benefits and consequences of these linguistic choices within the context of academic discourse by

examining relevant studies. By analyzing these approaches, this research aims to provide insights into the impact and implications of language choices in academic communication.

Corpora, extensive compilations of written or spoken texts, have emerged as invaluable assets for academic writers. Scholars utilize corpora to meticulously scrutinize linguistic patterns, discern prevalent collocations, and acquire profound understandings of language usage within particular contexts. Through the analysis of authentic language data, researchers are empowered to make well-informed decisions concerning language selection in their own writing, encompassing aspects such as the strategic implementation of hedging and the usage of personal language.

Hedging in academic writing requires adopting cautious and mitigating phrasing to express skepticism or qualify assertions. It enables authors to acknowledge the limitations of their arguments, consider other interpretations, and demonstrate intellectual humility (Hyland, 1996). Scholars commonly employ hedging to avoid overgeneralization and to present their findings as uncertain rather than absolute facts

The present research follows a structured framework consisting of an Introduction, Methodology, Data Analysis, and Conclusion. The Introduction section sets the stage by providing an overview of the research objectives and the significance of the study within the academic domain. It highlights the specific aspects under investigation, namely the usage of hedging and the frequency of personal pronouns in academic research writing. The Methodology section outlines the research design employed to address the research question. In this case, the focus is on undergraduate students from the Faculty of Law at General Sir John Kothalawala Defense University, and a representative sample of proposal writings is collected for analysis. The Data Analysis section involves processing and analyzing the collected proposal writings to quantify the frequency of hedging and personal pronoun usage. Comparative analysis is conducted to examine variations in usage patterns across different proposals, and statistical techniques may be applied to determine the significance of

observed differences. The Conclusion section presents the key findings derived from the data analysis and discusses their implications in relation to the research objectives. It provides a summary of the research outcomes and offers insights into the linguistic characteristics of academic writing, particularly with regard to hedging strategies and the role of personal pronouns. Finally, the study concludes by presenting recommendations for future research, highlighting potential areas for further exploration, and suggesting avenues for expanding on the findings of the present study.

## II. METHODOLOGY

### A. Research Design

Corpus research offers researchers a comprehensive understanding of the usage of academic materials through various academic writing methods. By employing both quantitative and qualitative approaches, researchers can delve into the frequency, distribution, relevance, and functions of specific linguistic characteristics. According to Hyland (2016), this combined approach enables scholars to grasp how academic language is constructed, agreed upon, and comprehended. Quantitative techniques, such as identifying frequencies and variations associated with particular linguistic features, are complemented by qualitative analysis that investigates the purposes and significance of these features in their contextual settings. This mixed-methods approach provides for a more nuanced examination of the numerous characteristics of academic writing and helps to a better understanding of the complexities of language in the academic context.

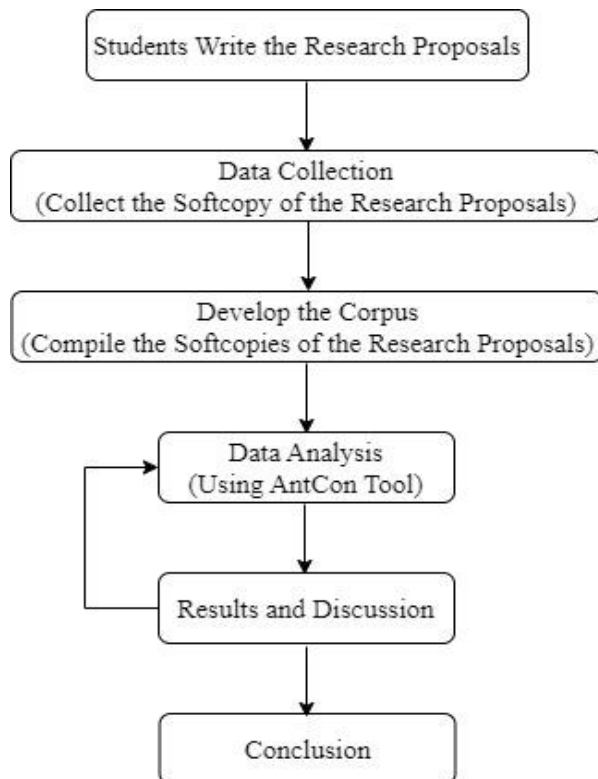


Figure 1 – Research Design

The primary focus of the present research was to investigate the frequency of hedging and personal pronoun usage in research writing by undergraduate students. To achieve this, a sample of twenty-six research proposals was obtained from students belonging to the 38th intake of the Faculty of Law at General Sir Kothalawala Defense University. The sample consisted of twenty-two-day scholars and four foreign students, all within the age range of 20 to 23 years. The research objectives encompassed examining the utilization of hedging in academic research writing, exploring the frequency of personal pronoun usage in academic research writing, and introducing a mini corpus, namely the Academic Writing in Research Corpus (AWRC), to facilitate future research endeavors.

The subsequent step involved creating a mini corpus as a tool for data analysis. "A corpus is a body of systematically gathered texts or transcribed speech to represent a particular function of a language that can serve as the basis for linguistic analysis and description (Park & Nam 2017)".

The research proposals of all twenty-six students were extracted into a text file, excluding unnecessary details such as titles, sub-headings, spaces, and punctuations. To compile the mini corpus, the data from the text files were copied into the AntConc Concordance, a software tool that was downloaded for this purpose. Subsequently, the frequency option in AntConc was utilized to gather the respective findings. Through comparative analysis, these findings were then evaluated to draw conclusions.

## III. DATA ANALYSIS

### II. Using of personal Pronouns

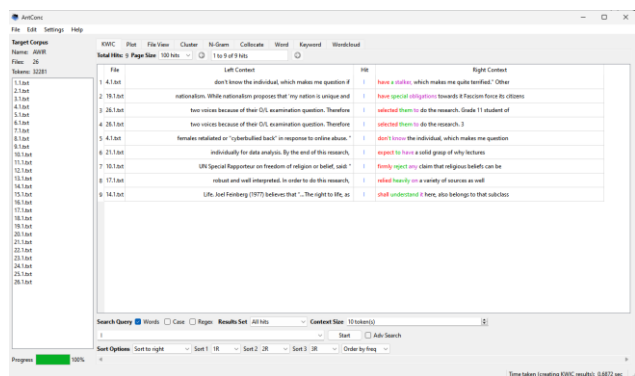


Figure 2- Comparison of using “I” and “We” forms in academic research writing

In academic writing, the primary focus is on presenting information and ideas in an objective manner, prioritizing evidence and logical reasoning over personal opinions or subjective experiences. Overusing the first-person pronoun "I" can introduce bias and subjectivity, shifting the focus from the subject matter to the author. Moreover, it can result in repetitive sentence structures and unnecessary

self-references. Hence, it is recommended to exercise restraint when using the first-person pronoun in order to maintain an objective and concise writing style. By minimizing the use of "I," writers can enhance the clarity and effectiveness of their academic work, ensuring that the emphasis remains on the content rather than the author's personal perspective.

Indeed, it is crucial to acknowledge that the appropriate usage of the first-person pronoun "I" in academic papers can vary depending on disciplinary norms, research methodologies, and the specific writing context. While personal viewpoints and experiences can hold relevance, it is essential to integrate them thoughtfully into the broader scholarly discourse and adhere to the conventions and expectations of academic writing. As demonstrated by the data provided, the frequency and manner in which students employ the pronoun 'I' in their academic writing can significantly impact the overall academic conviction of their work. Striking a balance between incorporating personal perspectives and maintaining a scholarly tone is key to achieving an effective and persuasive academic writing style.

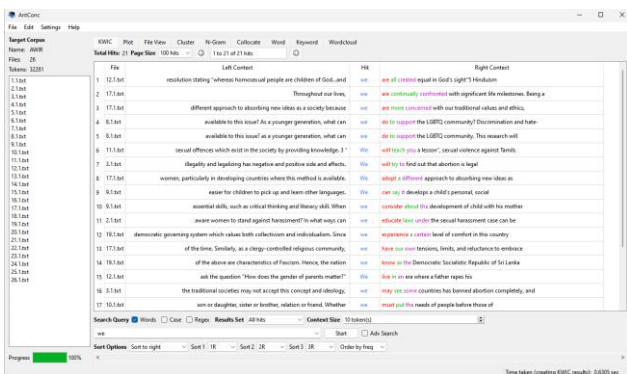


Figure 3- Usage of the pronoun “we” in research proposals

Using the pronoun "we" without clearly defining the individuals or groups it represents can result in ambiguity. Without specifying who exactly is included in this collective, readers may find it challenging to identify the specific actors or contributors involved in the research or argument being presented. This lack of clarity can impede the understanding of the work and diminish the overall effectiveness of the writing. It is crucial to provide explicit information about the parties included in the pronoun "we" to ensure transparency and facilitate comprehension for readers.

Achieving a balanced and appropriate use of pronouns, including "we," in academic texts is essential for ensuring clarity, precision, and a nuanced representation of individual and collective viewpoints. Authors must carefully consider the context, disciplinary standards, and specific objectives of their writing when determining the

acceptable use of pronouns. The provided statistic indicates that the usage of the pronoun 'we' in the context mentioned violates academic conventions and formalities. Moreover, using 'we' in individual research can indicate a lack of understanding of proper grammar among undergraduate students. It is crucial for authors, especially students, to adhere to established grammar rules and academic writing guidelines to maintain the integrity and professionalism of their work.

While examining the distribution of pronouns "we" and "I" in research papers can provide valuable insights, it is equally important to acknowledge the potential negative implications of imbalances in their usage. In this analysis, "we" accounts for 65.4% and "I" for 34.6%, highlighting the need to consider their respective drawbacks in academic writing. While the inclusion of "we" and "I" can enhance reader involvement, excessive use of either pronoun can lead to reader disengagement. An over-reliance on "we" may create a sense of detachment or alienation from the discourse, while the overuse of "I" can convey a self-absorbed or egotistical tone. To maintain reader interest and engagement, it is crucial to strike the right balance between inclusivity and individual expression. By finding this equilibrium, academic writers can effectively convey their ideas while maintaining a sense of connection with their readers.

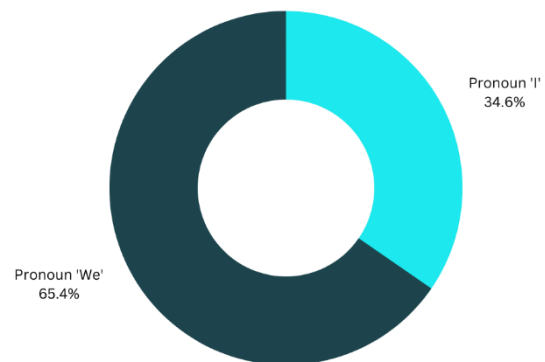


Figure 4: Comparison between the usage of pronouns I and We

In conclusion, examining the usage of pronouns "we" and "I" in academic papers highlights the potential negative consequences of imbalances in their usage. These disadvantages encompass issues of clarity, a subjective or personal tone, the risk of bias, a disregard for disciplinary standards, and a potential decrease in reader interest. Striking a balance between these pronouns is essential for effective communication, authenticity, and reader engagement within the academic writing context. By achieving this equilibrium, writers can maintain a clear and objective tone while still conveying their ideas and

fostering meaningful engagement with their readers. It is crucial to recognize the importance of thoughtful and deliberate pronoun usage in order to uphold the integrity and impact of academic writing.

### Hedging Frequency

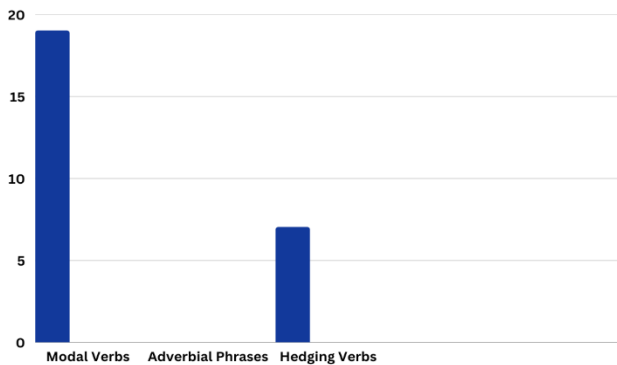


Figure 5: Usage of types of hedging in Academic writing

The utilization of modal verbs in proposal writing holds significant importance as it allows writers to convey their attitude, express varying degrees of confidence, and underscore crucial elements of the proposal. This descriptive study specifically focuses on examining the usage of commonly employed modal verbs within 17 out of 26 proposals authored by students. By analyzing the patterns and frequencies of these modal verbs, this study aims to shed light on their role in shaping the rhetorical stance and persuasive impact of proposal writing.

Modal verbs play a crucial role in proposal writing as they allow writers to convey a range of attitudes, including certainty, possibility, duty, and recommendation. In the context of hedging, it is notable that 19 out of the 26 undergraduate students included modal verbs in their proposal writing. The frequency of usage varies among these modal verbs, but it appears that students heavily rely on modal verbs in their proposals to articulate their objectives and perspectives. Common modal verbs employed by undergraduates include "will," "would," "should," "could," and "may." The presence of these modal verbs indicates the students' intention to express their intentions and navigate the nuances of their proposals effectively.

Based on the research findings, it has been observed that adverbial phrases are not commonly utilized in undergraduate proposal writing. This suggests that students may not employ adverbial words to provide additional information or modify actions, situations, or circumstances in their proposals. The absence of adverbial phrases indicates that students may rely on alternative linguistic strategies, such as the use of modal verbs and specialized

word choices, to convey their ideas and assertions effectively within their proposals. The reliance on these alternative methods may compensate for the limited use of adverbial phrases in undergraduate writing, allowing students to express their thoughts and claims in a concise and impactful manner.

In academic writing, particularly in the context of proposal writing, the use of hedging verbs serves the purpose of introducing caution, ambiguity, or qualification. The statistical analysis reveals that undergraduates exhibit a relatively low frequency of hedging verb usage in their proposals, with only 7 out of the 26 students incorporating hedging verbs. This suggests that students may not rely on hedging verbs as extensively as they do on modal verbs. It is important to acknowledge that the specific choice and frequency of hedging verbs employed by students may vary, influenced by individual writing styles and academic conventions. Therefore, it is essential to consider the nuances of each student's usage of hedging verbs within the broader context of their writing.

It is important to acknowledge that the findings of this research are based on the specific dataset analyzed and provide a general overview of the patterns observed in undergraduate proposal writing. It is crucial to recognize that individual writing styles and disciplinary conventions may vary among students, which can influence their use of language and writing patterns. Therefore, while this research provides valuable insights into undergraduates' proposal writing, it is essential to consider the unique characteristics and variations that may exist within individual writing styles and disciplinary traditions.

### IV. CONCLUSION

Academic writing holds great significance in the process of knowledge creation and sharing, and scholars employ diverse strategies to enhance the efficiency and lucidity of their work. This comparative research focuses on investigating the usage of corpora in academic research and delving into how various studies tackle the use of hedging and personal pronouns. The primary goal of this research was to provide a deeper understanding of the advantages and drawbacks associated with these linguistic choices within the realm of academic discourse, through a comprehensive examination of pertinent studies. By analyzing and evaluating these approaches, this research aims to offer valuable insights into the impact and implications of language choices in academic communication.

The primary objective of academic writing revolves around the contribution it makes to the existing reservoir of knowledge pertaining to a specific subject (Brown, 2018). Through rigorous research, meticulous examination of pre-existing literature, and the presentation of original ideas, academic writers enhance intellectual discourse and

expand the boundaries of knowledge. Furthermore, academic writing serves as a catalyst for intellectual advancement and facilitates the dissemination of information within the realm of academia on a global scale (Jones, 2020).

The current study, utilizing sample data, has provided a comprehensive analysis of the usage of personal pronouns and hedging in academic writing, specifically within research proposals. The findings from the data have revealed that students possess limited awareness of the distinctive features of academic writing, as evidenced by their excessive use of first-person pronouns such as "I" and "We." Additionally, the study has highlighted the inadequate utilization of adverbial phrases in research writing. Consequently, it is recommended to prioritize the instruction of diverse hedging techniques in research writing, as this will prove advantageous in both academic and professional contexts. Such an approach will contribute to the development of effective communication skills within these domains.

## V. RECOMMENDATION

- 1) The utilization of a mini corpus can be employed to effectively analyze and identify errors in academic writing. By incorporating a small collection of texts representative of the academic context, researchers and educators can gain valuable insights into common mistakes and areas that require improvement.
- 2) Consider implementing the use of a mini corpus in school education, particularly at the onset of university education. Introducing students to the analysis of authentic academic texts early on can familiarize them with the conventions and expectations of scholarly writing, enhancing their academic preparedness.
- 3) Emphasize the development of academic literacy as a central component across all degree programs to cultivate a stronger academic culture. By prioritizing the acquisition of essential academic skills, such as critical reading, effective writing, and proper citation practices, students can enhance their ability to engage in rigorous scholarly discourse and contribute meaningfully to their respective fields.

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## ABBREVIATIONS AND SPECIFIC SYMBOLS

KDU - General Sir John Kothalawala Defence University  
AWRC - Academic Writing in Research Corpus

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# Development of an Intelligent Software Solution for AI -Enabled Stethoscope: Accurate CAD Diagnosis and Real-time Feedback System

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**Abstract**— Although the classic stethoscope has long been a crucial diagnostic tool for cardiac conditions, it has an elementary level of accuracy in diagnosis capability. And mainly the diagnostic capability of traditional stethoscope relies on the listener's experience and expertise. Number of cardio patients are increasing day by day due to the low accuracy rate of the traditional stethoscope. And it has very limited capability to provide real time feed-back during auscultation. So, here we decided to develop software prototype for a tube-free intelligent stethoscope that not only diagnoses heart diseases but also provides real-time feedback and guidance during heart auscultation. This uses modern machine learning algorithms and real-time signal processing to diagnose heart problems accurately and quickly while providing real-time feedback to assist physicians during the heart auscultations. Here we specially focused on CAD (coronary artery disease). It captured audio signals from patient's heart using sensors and thereby the collected audio signals are preprocessed and converted into spectrograms using short-time Fourier transform (STFT) for frequency domain analysis. Then the trained convolutional neural network (CNN) model achieves a high accuracy rate in differentiating between normal and abnormal heart sounds, enabling accurate CAD diagnosis. And finally, we got an accuracy rate of 65 %. This research has significant implications for cardiology and healthcare, revolutionizing heart disease diagnosis by enabling faster, accurate, effective, and early diagnosis. The integration of real-time feedback and guidance during auscultation provides valuable insights for effective diagnosis and future enhancements in clinical settings.

**Keywords**— Tube-Free Intelligent Stethoscope, AI, software prototype, Coronary Artery Disease (CAD), Convolutional Neural Network (CNN), Cardiology, real-time heart sound analysis, feedback system, machine learning, deep learning, diagnosis, healthcare, heart auscultation, signal processing

## I. INTRODUCTION

“Ough!!! I have chest pain “is common in present all over the globe over the people with every walk of life. And they define it simply as gastritis by being physicians to

themselves without any proper guidance of a doctor or any person assist in medical field. And if not, there is a probability that they will direct to the small medical centers near their houses, or may be a less probability that they will directed to the hospitals in the nearest city. Then after that doctor or the health worker in that specific place use traditional stethoscope to hear heart auscultation of the patient. As the outer environment is not such a mediatable & calm environment and instead it is with a surrounding of people talking, generators humming, boom of a moped on the main road , sounds of vehicles outside , sound of vehicle beepers in traffic and other unnecessary sounds of people ,the medical professional struggles to hear the heart auscultation through the general stethoscope ,so it lost their diagnosis accuracy of the heart diseases increasing the mortality rate .And the same time it fails to diagnose any heart disease by hearing abnormal lub-dub sound in the heart at its initial stage due to the limitations of the traditional stethoscope.(Gupta et al. 2022) Normal stethoscopes have a limited frequency range, typically around 20 HZ to 200 HZ. So, this range is incapable of capturing high -frequency sounds or subtle variations that could be indicative of certain cardiac conditions. And CAD is a fatal disease that is only can be diagnosed by general stethoscope when 40 % of it is developed in the heart .It means that the abnormal heart rhythm which could be heard by the traditional stethoscope is generating only, after developing the CAD in the heart up to 40%.(Bachtiger et al. 2022) So to diagnose it in the initial stage, our intelligent stethoscope will contribute a lot. And at the same time we got to know that the auscultatory findings with a normal stethoscope relies heavily on the listener's expertise and experience .And different healthcare professionals may have varying skills, abilities and experiences in identifying and distinguishing specific heart sounds or abnormalities, leading to subjective interpretations. So we wanted to make an equality among all the health care professionals meaning that not to depend diagnostic accuracy on the skills of the physicians.(Grzywalski et al. 2019; Bachtiger et al. 2022) And we acknowledged that traditional stethoscopes do not provide sufficient amplification or filtering capabilities causing difficulties to discern faint or abnormal heart sounds, particularly patients with obesity, chest

deformities, or other factors will affect to the sound transmission through the general stethoscopes. And at the same time traditional stethoscopes haven't any ability to record or store auscultation findings for later review or comparison. These limitations could interrupt longitudinal monitoring, collaboration between doctors, and accurate documentation of patient records. And also normal stethoscopes do not possess any analytical capabilities to automatically detect or diagnose any cardiac conditions. And another main issue with traditional stethoscopes is that it has no integration with any digital health platform or telemedicine systems which is so much needed with current technologies. So, the tube-free AI-based intelligent stethoscope addresses these limitations by leveraging advanced machine learning algorithms and signal processing techniques. By converting heart sounds into digital data, it allows for automated analysis and pattern recognition, enabling the detection of subtle abnormalities that might be unnoticed with the general stethoscope.(Suzuki et al. 2022)

CAD (coronary artery disease), is a prevalent and significant health concern worldwide, including Sri Lanka. It is a long-term condition that refers to the narrowing or blockage of the coronary arteries, which supply blood and oxygen to the heart muscle, resulting in various symptoms. In Sri Lanka CAD has emerged as a leading cause of morbidity and mortality in recent years. According to the latest WHO data published in 2020 Coronary Heart Disease Deaths in Sri Lanka reached 26,304 or 22.66% of total deaths. So this much of people has died from this severe disease-causing burden on the healthcare system. So first, our idea was to reduce the mortality rate of population from the CAD disease and to make a healthy Sri Lanka with lowest rate of cardio-vascular diseases. So for this we initially thought to increase diagnosis accuracy at the initial stage of CAD. That is how the idea of tube-free intelligent stethoscope came here. This intelligent stethoscope incorporates a real-time feedback system, providing immediate guidance to the physicians during heart auscultation. So we expect through visual and auditory cues, it assists in the identification of specific heart sounds and abnormalities reducing the patient population with CAD causing reduction of the mortality rate. This interactive feedback system empowers healthcare professionals, especially those with limited experience in cardiology, to make informed decisions and improve the accuracy and efficiency of their diagnoses.

Finally, our aim of this research is to introduce this innovative tube-free AI-based intelligent stethoscope designed to revolutionize the field of cardiac diagnostics. By integrating artificial intelligence and real-time heart sound analysis, this intelligent stethoscope aims to overcome the limitations of traditional auscultation

methods and provide enhanced diagnostic capabilities, immediate feedback, and personalized patient care.

## II. LITERATURE REVIEW

### A. LungBRN: A Smart Digital Stethoscope for Detecting Respiratory Disease Using bi-ResNet.

The team of scientists had invented a rudimentary classification of lung sounds using a digital stethoscope that utilized to provide a fast & accurate diagnosis for respiratory-related disorders such chronic obstructive pulmonary disease in situations when there is a significant shortage of experienced medical staff.(Aykanat et al. 2017) They had developed an improved bi-ResNet deep learning architecture, LungBRN, which uses STFT and wavelet feature extraction techniques to improve accuracy. They had used the official benchmark standards and the "train-and-test" dataset splitting procedure stated in the ICBHI 2017 challenge. Finally, they achieved a performance of 50.16%, which is the best result in terms of accuracy compared to all participating teams from ICBHI 2017.

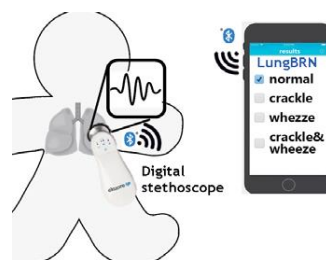


Figure 4. A line graph using colours

### B. Engineers from Johns Hopkins introduced a stethoscope with an AI upgrade for accurate pneumonia diagnosis

A collaboration among engineers, doctors, and public health experts at Johns Hopkins University, in Baltimore completely rethink the stethoscope to develop it as an Intelligent stethoscope with AI upgrade specially to diagnose the severe lung disease "pneumonia" with the increasement of the pneumonia patients in the region. (Attia et al. 2022) They develop the intelligent stethoscope with the aid of Pulmonologists specially focused about child pneumonia which is the major reason of increasing the mortality rate of children population. This stethoscope is made with the techniques of prior diagnosis of pneumonia biased on the noise-cancellation algorithm that uses active and adaptive acoustics.(Correction to Lancet Digit Health 2022; 4: e37-45 (The Lancet Digital Health (2022) 4(1) (e37-e45), (S2589750021002284), (10.1016/S2589-7500(21)00228-4)). 2022) .The Upgrade of this device had started with its hardware, where the chest piece is packed with transducer arrays to achieve a uniform sensitivity over the entire active area. This design



delivers a strong signal even when the chest piece isn't placed in precisely the right location, which gives a major assist to untrained users. And it is stated that they had experimented with a variety of transducers, including microelectromechanical systems (MEMS), which had allowed to pack many microphones into a small area, as well as nanofiber materials that match the acoustic properties of skin to limit signal loss. This intelligent stethoscope has an external microphone that records ambient sounds, and the system uses active and adaptive acoustics to remove those sounds, in real time, from the digitized audio signal transmitted to the user's ears. Pulmonologists are trained to ignore other body sounds, such as the heartbeat, when they listen to the lungs. As same as the way the smart scope detects those extraneous sounds and removes them, too. This algorithm trained on a database of recordings of about 1,500 patients from five African countries and two Asian countries and after testing with the AI-enabled app, they found that it could automatically distinguish healthy people from those with pneumonia with an accuracy of 87%, far surpassing other automatic diagnosis methods. And they worked on this algorithm, aiming to improve its performance with machine learning techniques. Health workers in rural clinics could use our smart stethoscope even if they don't have access to the Internet, the onboard technology does all the processing and provides an instant recommendation on diagnosis using a small built-in LED display. And the Johns Hopkins smart scope is designed to be significantly cheaper, with affordable electronic components and low-cost power and computing options, in hopes that it can be useful for lower source communities. They had created a noise-cancellation algorithm that uses active and adaptive acoustics. Instead of just setting up a filter and letting it run in a passive way, this system analyzes both lung sounds, and ambient sounds recorded by the external microphone, looking at their frequencies on the audio spectrum. Then after app adapts the degree and spectral span of noise cancellation as the algorithm tracks the two signals over time. As in a such a way they had develop this digital stethoscope specially based on the "noise cancellation system." Finally, their intention was to make at least one parent sees her child recover because of early diagnosis, due to this AI based stethoscope.



Figure 5. A line graph using colours

### C. Development of a Finger-Ring-Shaped Hybrid Smart Stethoscope for Automatic S1 and S2 Heart Sound Identification

This is research that was developed by the group of scientists in Korea to improve the accuracy of auscultation, and to allow nonmedical staff to conduct cardiac auscultation anywhere and anytime, a hybrid-type personal smart stethoscope with an automatic heart sound analysis function. The device was designed with a folding finger-ring shape that can be worn on the finger and placed on the chest to measure photoplethysmogram (PPG) signals and acquire the heart sound simultaneously. The measured heart sounds are detected as phonocardiogram (PCG) signals, and the boundaries of the heart sound variation and the peaks of the PPG signal are detected in preprocessing by an advanced Shannon entropy envelope. According to the relationship between PCG and PPG signals, an automatic heart sound analysis algorithm based on calculating the time interval between the first and second heart sounds (S1, S2) and the peak of the PPG was developed and implemented via the manufactured prototype device. And they tested prototype device with 20 young adults, the experimental results showed that the proposed smart stethoscope could satisfactorily collect the heart sounds and PPG signals. This developed algorithm was as accurate in start-points of heart sound detection as professional physiological signal-acquisition systems. Experimental results from this device demonstrated that it was able to identify S1 and S2 heart sounds automatically with high accuracy.

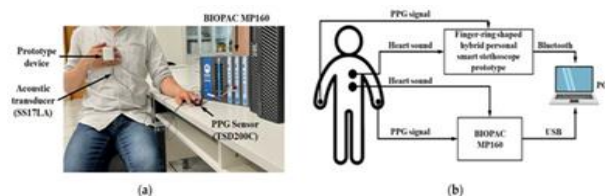


Figure 6. A line graph using colours

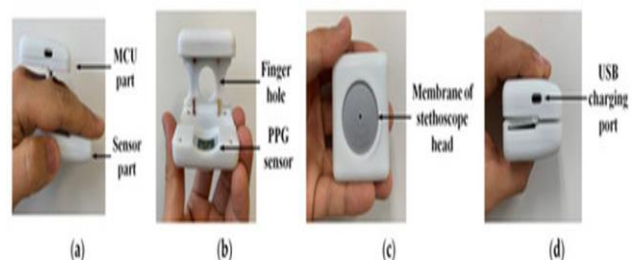


Figure 7. A line graph using colours

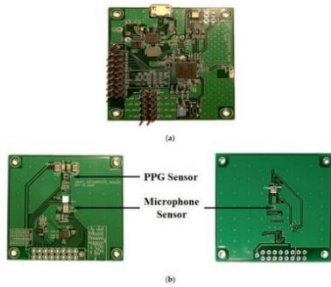


Figure 8. A line graph using colours

#### D. Real-Time Smart-Digital Stethoscope System for Heart Diseases Monitoring

Here the group of scientists from Malaysia, recognized that there is an unmet need for a portable system for the early detection of cardiac illnesses. And they proposed a prototype model of a smart digital-stethoscope system to monitor patient's heart sounds and diagnose any abnormality in a real-time manner.(Leng et al. 2015) This system consists of two subsystems that communicate wirelessly using Bluetooth low energy technology: A portable digital stethoscope subsystem, and a computer-based decision-making subsystem. The portable subsystem captures the heart sounds of the patient, filters and digitizes, and sends the captured heart sounds to a personal computer wirelessly to visualize the heart sounds and for further processing to decide if the heart sounds are normal or abnormal. In here the twenty-seven t-domain, f-domain, and Mel frequency cepstral coefficients (MFCC) features were used to train a public database to identify the best-performing algorithm for classifying abnormal and normal heart sound (HS). (Patel et al. 2022)The hyper parameter optimization, along with and without a feature reduction method, was tested to improve accuracy. And the used cost-adjusted optimized ensemble algorithm produced 97% and 88% accuracy of classifying abnormal and normal HS, respectively. Feature reduction, hyperparameter optimization, along with asymmetrical cost assignment in the training of algorithm were evaluated to obtain the best performance from this algorithm. So it is clear that scientist had tried hard to introduce and developed the concept of "smart Stethoscope" but here we tried to present it with an additional real-time feedback system to make it more innovative .

### III. METHODOLOGY

So here the objective of our research is to develop a tube-free intelligent stethoscope that not only diagnoses heart diseases (CAD) but also provides real-time feedback and guidance to the user during auscultation. Among the cardiac conditions in present, we mainly focused on CAD which is a deadly disease all over in Sri Lanka at the

present. And surely it will be an innovative attempt to rescue one's life from cardiologic diseases and revolutionize the field of cardiac diagnostics. So by integrating artificial intelligence and real-time heart sound analysis, this intelligent stethoscope aims to overcome limitations of traditional auscultation methods and provide enhanced diagnostic capabilities, immediate feedback and personalized patient care. So the findings of this research will have implications for improving clinical practice, facilitating early detection, reducing misdiagnosis rates and finally improving patient outcomes(Sau and Ng 2023). This research design combines data collection, pre processing techniques, AI model development and real -time feedback implementation system.

#### I. Data collection

The audio data used in this study were collected from patients with known heart conditions and individuals without heart diseases. A total of 900 heart sound recordings were obtained from various healthcare facilities, research institutions and public websites. The inclusion criteria for the recordings included individuals of different areas, ages, genders, and diverse cardiac conditions.

#### II. Data preprocessing

Here we used so many preprocessing techniques as Resampling, noise removal using filters, signal normalization, signal segmentation, signal amplification, denoising, Artifact removal, Data augmentation and baseline correction, prior to the analysis of audio data. In here the artifacts and irrelevant sounds were eliminated to ensure the quality and the reliability of heart sound recordings. In this preprocessing stage the input data were subject to so many pre -processing techniques in order to clean and enhance the audio signals, filter out noise, Amplify the signals, enhance the quality of signals and to extract relevant features from the set of audio data.

#### III. Feature extraction

To extract the relevant features from the preprocessed audio signals, feature extraction is taking place. In here the Time-domain features as duration, intensity and rhythm were extracted. Here we used STFT (Short Time Fourier Transform) to convert the time-domain audio signals captured by stethoscope in to spectrograms which will provide a visual representation of frequency content of heart sound over time And also the frequency-domain features, such as spectral content and dominant frequencies were computed using STFT . Statistical features , including mean ,variance and entropy were also calculated to capture additional information from the heart sound signals.

#### IV. Spectrogram Generation

It is a visual representation of the frequency content over time. Spectrogram generation is one of the main techniques

used in analyzing heart sounds. We wanted to develop it as a valuable insights into frequency components that present heart sound signals ,allowing detailed analysis and feature extraction .Here we used STFT which break down audio signals into smaller segments and applied Fourier Transform to each frame to obtain it's frequency contentment, which displayed a time – frequency representation of the preprocessed audio signal .And finally obtained a visual representation of the frequency content and changes in the heart sound over time ,and it was displayed on a small portable digital screen in the designing of this stethoscope to get a clear ,conscience idea about the heart rhythm rate over time . And we used SciPy and librosa in Python to compute the STFT and generate spectrograms from the audio data. And this spectrogram was used for further analysis, future extraction, and input to the CNN model for CAD identification and real -time feedback generation.

Then the spectrogram data were again preprocessed and organized with corresponding labels or annotations indicating the presence of heart abnormalities or classifications.

#### V. AI Model development using CNN

Here we used Convolutional Neural Network (CNN) architecture to develop the AI model. The CNN model was trained using the preprocessed heart sound data, with a training set comprising 80% of the data, a validation set of 10% and a test set of 10% . The model was optimized using the Adam optimizer with 0.001 learning rate. And also the loss function (categorical cross-entropy) is used, and the model was trained for 50 epochs . (And ReLU is used as the activation function here) In order to develop CNN model and to classify and diagnose abnormal heart sounds over normal heart sounds we used.

Then after training using CNN model it had the ability to predict new, unseen data to classify it as normal or abnormal data. And we tried to experiment with different configurations of convolutional and pooling layers to capture different levels of abstraction in the heart sound data. And finally added regularization techniques as batch normalization to prevent overfitting and improve generalization. Then the model was trained with a training set of data using batch-wise processing and backpropagation. Then this is the method that we used to classify abnormal cardiological audio patterns from normal ordinary patterns which cause the CAD conditions. So finally, we obtained an accuracy rate of 65%. Here in order to develop CNN model and to classify and diagnose abnormal heart sounds over normal heart sounds we used python libraries TensorFlow and pytorch.

```
import tensorflow as tf
from tensorflow.keras import layers
```

```
# Define the CNN model architecture
model = tf.keras.Sequential([
    layers.Conv2D(32, kernel_size=(3,3),
    activation='relu', input_shape=(input_height, input_width,
    input_channels)),
    layers.MaxPooling2D(pool_size=(2, 2)),
    layers.Conv2D(64, kernel_size=(3,3),
    activation='relu'),
    layers.MaxPooling2D(pool_size=(2, 2)),
    layers.Flatten(),
    layers.Dense(128, activation='relu'),
    layers.Dense(num_classes, activation='softmax')
])
# Compile the model
model.compile(optimizer='adam',
loss='categorical_crossentropy', metrics=['accuracy'])
# Train the model
model.fit(x_train, y_train, batch_size=batch_size,
epochs=num_epochs, validation_data=(x_val, y_val))
# Evaluate the model
test_loss, test_accuracy = model.evaluate(x_test, y_test)
# Make predictions
predictions = model.predict(x_test)
```

And still we had the real-time implementation & feedback system on the experimental stage. After the CNN model processes the spectrogram data and make the predictions, interpret the results based on the detected heart conditions or abnormalities and then we can define a set of rules to classify the predictions into different categories (e.g. - normal / abnormal / specific heart conditions) and also we can assign level of severity to each prediction based on the mode's output probabilities. And then we could customize the feedback system with visual cues, audio cues, textual feedback and with a Real-time guidance indicating the presence of abnormality or specific CAD condition. (Patel et al. 2022)

#### IV. DISCUSSION AND FUTURE WORKS

Findings from this research depict the successful development of the software prototype for the tube-free-AI based intelligent stethoscope with real -time heart sound analysis and feedback system.

So mainly this system combines advanced signal processing techniques, STFT, machine learning algorithms and real -time feedback mechanisms to enhance the accuracy and the usability in cardiac auscultation.

Comparing with the traditional stethoscope this system has so many advantages as Accurate diagnosis of CAD ,prior Diagnosis of CAD at its initial stages ,No need of any expert physician to diagnose any cardiac condition ,enable to detect subtle abnormalities that may be missed by human listener, ability of obtaining visual feedback using the spectrogram, obtaining real time feedback with the

cardiac condition of the heart and the ease of using this new device. And finally we can predict that this new design will enhance the accuracy, usability and standardization of the auscultation process.

However, it is important to acknowledge the limitations of our research. The performance of the intelligent stethoscope may be affected by variations in heart sound recordings, external noise interference and specific patient population. Further validation studies involving larger and more diverse patient cohorts are necessary to assess the system's accuracy and generalizability. (Neal et al. 2022)

And it is essential that, up to now we only developed the software prototype of this intelligent stethoscope, and we want to state that in future we aimed to develop the full hardware part of this stethoscope including the tube-free structure here. According to the opinion of so many physicians we got to know that tube in the traditional stethoscope is difficult when using due tangling, kinking and rigidity. So, we decided to make the hardware part, without the tube for our intelligent stethoscope in the future.

#### V. CONCLUSION

Finally, in this research we have developed a intelligent software part for a tube-free AI-based intelligent stethoscope with real-time heart sound analysis and feedback system, mainly aiming the CAD patient population to improve the accuracy and usability of cardiac auscultation. Through the integration of advanced signal processing techniques, machine learning algorithms and real-time feedback mechanisms our system has shown promising results in the early detection of CAD subsidizing the mortality rates of cardiac patients.

The implementation of AI algorithms has allowed the intelligent stethoscope to analyze heart sounds with higher level of precision, surpassing the capabilities of the traditional stethoscopes.

By leveraging a vast amount of training data, the system has demonstrated remarkable accuracy in identifying mainly the CAD including other various cardiac conditions. This breakthrough has the potential to revolutionize cardiology practice by enabling early detection and prompt intervention, ultimately leading to improved patient outcomes. And the real-time feedback system embedded in our intelligent stethoscope has proven to be an invaluable tool during the auscultation.

In conclusion, the development of a tube-free AI-based intelligent stethoscope with real-time heart sound analysis and feedback system represents a significant advancement in cardiac auscultation in Sri Lanka. This technology has

the potential to transform the field of cardiology by improving early detection, diagnosis, and management of heart diseases. By enhancing the diagnostic accuracy, usability, and standardization of the auscultation process, our intelligent stethoscope aims to empower healthcare professionals, improve patient outcomes, and reduce healthcare costs.

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# A Clustering Method to Identify Mental Health Patient Groups with Similar Treatment Outcomes

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**Abstract**— A person's complete emotional, psychological, and social well-being is referred to as their mental health. It has an impact on how people feel, think, and act, as well as how they act and react to obstacles in life. Maintaining positive relationships, accomplishing goals, and living a satisfying life all depend on having good mental health. No matter what one's age, gender, race, or financial situation may be, mental health concerns can present themselves in a variety of ways and can affect everyone. Anxiety disorders, sadness, bipolar disorder, and schizophrenia are typical mental health issues. An individual's capacity to work, study, and sustain relationships can all be significantly impacted by mental health issues. Thankfully, there are a variety of treatments available, including counseling, medications, and dietary adjustments. Prioritizing mental health and getting treatment when needed are crucial.

In the present study we analyze the treatments such as home treatments, early intervention and assertive outreach which were done focusing patients of United Kingdom. For this purpose, K-means clustering technique is used to cluster patients with similar disorders to categorize easily for their treatments. As a result of a considerable portion of the general population experiencing mental health issues at home point in their lives, mental health is a growingly important issue in the UK. Thus, this research will immensely help to get precautions at the correct time and to minimize mental disorders.

**Keywords**—Mental health, treatments, persons, issues, K-means clustering

## I. INTRODUCTION

In and of its own, mental wellness does not exist. It is a crucial and vital component of total health. The ability to form and maintain affectionate relationships with others, to participate in the social roles typically played in their culture, to manage change, recognize, acknowledge, and communicate positive actions and thoughts, as well as to manage emotions like sadness, are all indications of one's mental health. A person's mental health offers them a sense of self-worth, control, and comprehension of how their body and mind work. Environmental, social, psychological, and biological factors can have an impact

on mental health, just like they can with mental illness. In order to create healthy communities, which in turn can advance mental health, interaction between individuals and society becomes essential.

Internal variables that make someone more susceptible to mental illness include a lack of emotional resilience, low self-esteem and social standing, a sense of helplessness and being trapped, issues with one's sexuality or sexual orientation, social isolation, and poor integration. Poor social conditions (housing, poverty, unemployment), discrimination or abuse, cultural conflict, stigma, and a lack of autonomy have all been mentioned as external factors that contribute to this vulnerability.

A person in good mental health will have a strong sense of who they are, be able to build solid relationships, and still feel at ease by themselves. The Mental Health Foundation (MHF, 2008) notes that mental health is defined by how people think and feel about themselves and their lives, and that it affects their ability to initiate, develop, and sustain mutually emotionally satisfying relationships. The core senses of mental health are trust, challenge, competency, accomplishment, and humor. Additionally, they offer the capacities to develop psychologically, emotionally, intellectually, and spiritually. It is believed that one's mental health has an impact on their capacity to operate, take advantage of opportunities, and engage fully in family, job, community, and peer interactions. Physical and mental health are closely related since they both directly and indirectly influence one another. Thus, it is conceivable to propose that mental health is a condition of equilibrium in which a person is at peace with themselves, able to operate socially and to take care of both their basic and higher-functioning requirements. Positive functionality entails effectively navigating change, interpersonal interactions, and emotions.

Causes for mental health are complex and vary from person to person. Genetics, trauma and life events, brain chemistry, substance abuse, environmental factors, medical conditions, and social factors can become a factor which can contribute to develop someone's mental health issues. They are genetics, environmental factors, brain chemical

imbalances, medical conditions, abuse of drug and alcohol, significant life events and brain chemistries.

Mental issues can be treated in different ways such as home treatments, early intervention, and assertive outreach.

#### A. *Home treatments*

Even though it is always advisable to seek professional assistance for mental health difficulties, there are some at-home remedies that can be beneficial for managing symptoms and fostering mental wellbeing. Self-care practices, meditation and mindfulness, social support, therapy apps and online resources and meditation can be taken as examples for home treatments.

#### B. *Early Intervention*

Early intervention and treatment of mental health problems before they worsen or become chronic is referred to as early intervention for mental health concerns. The sooner help is provided, the more likely it is that the patient will recover swiftly and avoid developing new problems. Psychotherapy, medication, self-help tactics, support groups, family therapy and early psychosis intervention can be taken as the ways early intervention treatments happen.

By identifying mental health issues early and providing appropriate treatment, individuals can avoid more severe complications, improve their quality of life, and achieve better long-term outcomes.

#### C. *Assertive outreach*

Assertive outreach is a form of therapy strategy that focuses on giving people with severe and enduring mental health problems who might have trouble interacting with conventional mental health services intense, community-based support. Assertive outreach aims to offer continuing assistance and care to people in their natural settings, such as their homes or communities, in order to improve their independence and quality of life. Those who have previously failed to interact with conventional mental health services or who frequently end up in the hospital or face other crises may benefit from assertive outreach therapies. Assertive outreach can enhance results and reduce the necessity of additional intense treatments by offering continuous support and care in the individual's home environment. Regular contact, multidisciplinary team, flexibility, and holistic approach can be taken as the ways assertive outreach method work.

An older person's capacity to perform fundamental daily tasks can be significantly impacted by mental health issues, which can lower their independence, autonomy, and quality of life. Making a diagnosis is the first step in minimizing these detrimental effects. Unfortunately, too

many older people struggle on without the right support or any help at all since mental health issues are frequently left misdiagnosed and untreated.

It seems unlikely that the older adult population of today will acknowledge mental illness or use mental health services. Regarding the definition of mental illness, there are numerous stigmas. Many senior citizens consider mental illness to be a show of weakness and are reluctant to confess they have issues, especially if they worry about losing their independence. Too many individuals believe that sadness and dementia symptoms are inevitable parts of aging. Additionally, many older persons lack access to and availability of services.

The World Federation for Mental Health selected older people's mental health and wellness as the 2013 World Mental Health Day's topic. This is an excellent time to consider the global status of older persons with mental illnesses. This issue of Mental Health in Family Medicine is a contribution to this thought and a confirmation that working together between teams of primary care providers and experts in geriatric mental health is not only feasible, but also imperative.

The data from the Community Mental Health Activity (Community MHA) Omnibus return and the quarterly data from the Mental Health Minimum Dataset (MHMDS) version 4 are combined in this document as a background quality report. The normal quarterly MHMDS reports' main goal is to inform the public, commissioners, and the DH on adult specialist mental health services that are financed by the NHS. The normal quarterly MHMDS reports' main goal is to inform the public, commissioners, and the DH on adult specialist mental health services that are financed by the NHS.

## II. LITERATURE REVIEW

### A. *Mental health of UK firefighters*

This research paper investigates the psychological state of UK firefighters. According to the study, which featured a survey of 548 firefighters, mental health illnesses are more common among firefighters than in the general population. According to the study, firemen are more likely to experience PTSD, sadness, and anxiety. The study also discovered that characteristics related to the workplace, such as trauma exposure, demanding jobs, and a lack of social support, were linked to an elevated risk for mental health issues. The study emphasizes the significance of offering firefighters mental health support and addressing workplace conditions that exacerbate poor mental health. The results of this study can guide actions and laws intended to enhance the mental health of UK firefighters.

*B. Latent profiles of childhood psychological maltreatment and their links to adult mental health in China and the UK*

This study investigates the connections between latent profiles of childhood psychological abuse and adult mental health in China and the UK. 821 individuals from both nations participated in the study overall and filled out a self-report questionnaire. Four unique profiles of psychological abuse—low maltreatment, moderate-to-high covert maltreatment, moderate-to-high overt maltreatment, and severe and pervasive maltreatment—were discovered using latent profile analysis. According to the study, both countries' greatest rates of adult mental health issues, such as PTSD and depression, were connected with the severe and pervasive maltreatment profile. Moreover, a profile of moderate to severe overt abuse was linked to higher levels of mental health issues. The study emphasizes the significance of recognizing and treating child psychological abuse in order to prevent long term mental health consequences.

*C. The Impact of COVID-19 on Farmers' Mental Health: A Case Study of the UK*

The study looks into how COVID-19 has affected the mental health of farmers in the UK. 14 farmers and 4 stakeholders that work with farmers were interviewed as part of the study's case study methodology. The COVID-19 epidemic has significantly impacted the mental health of farmers in the UK, according to the study. Increased financial strains, social isolation, and worries about the future of agriculture have all been brought on by the pandemic. Farmers now experience higher levels of stress, worry, and despair as a result of these issues. The survey also discovered that because of perceived stigma and a lack of knowledge about available support, farmers were hesitant to seek help for their mental health issues. The results of this investigation show the need for targeted mental health support for farmers, as well as increases awareness and education on mental health issues in the farming community.

*D. At home or in hospital: Home treatment and mental health stigma*

The stigma associated to home care for mental health patients is explored in the article "At home or in hospital: Home treatment and mental health stigma" by Allerdiena A Hubbeling and Jared G Smith. Although home therapy provides a number of benefits over hospitalization, including cheaper costs and more comfort, the authors contend that it is frequently stigmatized as a less desirable or "second-best" choice. The essay looks at the causes of this stigma, such as cultural misconceptions about mental illness and the idea that receiving care at home amounts to "giving up" on the patient. The authors contend that in order to overcome this stigma, attitudes toward mental

illness must change, and the advantages of home therapy must be better understood. They also emphasize how crucial it is to offer sufficient assistance.

*E. Work-From-Home in the New Normal: A Phenomenological Inquiry into Employees' Mental Health*

The effect of the COVID-19 epidemic on the mental health of workers who work from home is examined in the article "Work-From-Home in the New Normal: A Phenomenological Exploration into Employees' Mental Health" by Mumtaz Ali Memon, Saba Shaikh, Muhammad Zeeshan Mirza, and Hiram Ting. The authors study employee experiences and views using a phenomenological approach, paying particular attention to the benefits and challenges that come with working remotely. The article addresses a number of important themes that arose from the investigation, such as the challenges of juggling work and personal obligations, the value of social support, and the requirement for distinct lines separating work from non-work activities. The writers also go over some possible advantages of working remotely, like more freedom and shorter commutes. Overall, the article recommends that while remote work has both advantages and disadvantages, it is important for employers to prioritize the mental health and well-being of their employees, particularly in the context of the pandemic.

*F. Health behaviors and subsequent mental health problems during the COVID-19 pandemic: A longitudinal analysis of adults in the UK*

The study "Health behaviors and subsequent mental health problems during the COVID-19 pandemic: A longitudinal analysis of adults in the UK" looked at the relationship between COVID-19-related health behaviors and subsequent mental health issues in people in the UK. The COVID-19 Social Study, a longitudinal panel survey with more than 70,000 participants, provided the data for the study.

According to the study, maintaining healthy habits like regular exercise and a balanced diet was linked to less instances of mental health issues during the epidemic. On the other hand, harmful behaviors like smoking, consuming alcohol, and binge eating were linked to increased rates of ensuing mental health issues. The study also discovered that people who at the beginning of the epidemic reported higher levels of stress, worry, and depression were more likely to engage in harmful behaviors and less likely to engage in beneficial ones.

*G. g. A systematic review of the predictors of health service utilization by adults with mental disorders in the UK*



A systematic review that was published under the title "A systematic review of the predictors of health service utilization by adults with mental disorders in the UK" looked at studies done in the country to determine the predictors or characteristics that affect how often adults with mental disorders use health services. To comprehend the factors that affect how people with mental disorders seek and use health services in the UK, the review examined a number of studies.

The systematic review's conclusions identified a number of determinants of health service use by persons in the UK who have mental illnesses. These predictors included clinical criteria including the kind and severity of mental disorders, co-occurring physical health issues, and the intensity of the symptoms, as well as sociodemographic factors like age, gender, ethnicity, and socioeconomic position. Access to healthcare resources, the availability of social support, cultural considerations, and individual ideas regarding mental health and treatment were additional predictors.

### III. PROBLEM STATEMENT

Clustering is unsupervised data mining technique that identifying and grouping similar data points in larger datasets without concern for the specific outcomes. It is a process of grouping records and observations to create a class of items with similar characteristics' cluster is a group of records that are similar to choose in another cluster. Clustering is critical in data mining applications such as scientific data exploration, information retrieval, text mining, visual data base applications and web analysis. There are many industries where using an unsupervised learning algorithm can be beneficial and insightful sellers want to group similar consumers for targeted marketing campaigns, biologists want to find plants with similar characteristics, and so on. We will investigate whether it is appropriate to use clustering techniques to categorize medical patients.

We'll look at anonymous people who have been with mental illness. Patients with similar characteristics may respond to similar mental health discourses, outcomes of patients with similar characteristics to those being treated.

### IV. METHODOLOGY

K-Means Clustering is an unsupervised learning method used to solve clustering problems in machine learning or data science. The algorithm aims to minimize the variance of the data points within each cluster and maximize the variance between the clusters. The K in "k-means" refers to the predetermined number of clusters that the algorithm aims to identify. The user specifies this number at the start of the algorithm. The algorithm then randomly selects K

initial cluster centers, which are used to assign each data point to a cluster. which divides the disordered dataset into several clusters. For an example, if  $K=2$ , two clusters will be produced, if  $K=3$ , three clusters will be produced, and so on. It enables us to cluster the data into different groups and provides a convenient method for discovering group categories in an unlabeled dataset without the need for training. It is a centroid-based algorithm, with a centroid for each cluster.

#### *Data collection*

The data set comes from the open data program of the UK government.

The Mental Health Minimum Data Set (MHMDS) is a routine data return from providers of adult secondary mental health services funded by the NHS that is created as part of providing services to patients. The Monthly Mental Health Dataset Reports have replaced this dataset. The Mental Health Minimum Data Set (MHMDS) is a routine data return from providers of adult secondary mental health services funded by the NHS that is created as part of providing services to patients.

It has information on every adult (including senior citizens) over the age of 18 who receives specialised secondary mental health treatments supported by the NHS and who is, or may be, experiencing, a mental illness. When children and teenagers under the age of 18 are receiving treatment from an early intervention program or a specialized adult secondary mental health service, they should be included as well.

#### *About data set*

Excel reference tables in a style similar to prior years that include aggregate numbers of people in contact with these services, inpatient activities, care contacts, and uses of restrictive interventions in inpatient services.

Data from 69 NHS-funded providers were included in this dataset. The tentative data was separated into the following groups:

There have been 120,259 episodes of home treatment so far this year.

247,854 assessments have been made by the Crisis Resolution team so far this year, and 98,280 patients have received home treatment.

At the end of the quarter, there were 21,886 patients being treated by Early Intervention teams;

At the end of the quarter, 19,843 people were getting Assertive Outreach services.

#### *Data pre processing*

Before moving on to data pre-processing install two packages called cluster and factorextra to analyze the data. After Import the data set used the head (), tail () functions to get a quick view of data set and used dim () function to check how many rows and columns are in the data frame.

According to data frame there are 151 rows and 9 columns. Before we begin clustering, we should conduct some exploratory data analysis to better understand the data set's attributes. we checked the dataset for any null or NA values, and if any were found, we had to remove them. Then we inspected the dataset's summary by using summery () function.

By using normalize function then we normalize the data set. Remove organization column before normalize and after normalize again add the organization column.

### V. RESULTS AND DISCUSSION

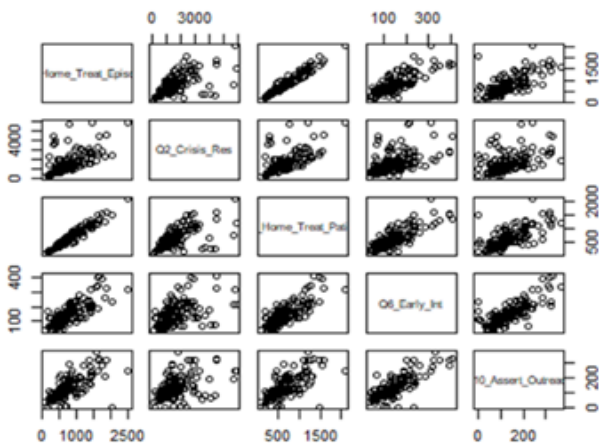


Figure 1 – Correlation plot

This plot created by using pairs () Function. The pairs () function can be very useful for quickly visualizing the pairwise relationships between multiple variables in a dataset. It can help identify potential patterns and relationships between variables. This plot shows the relationship between the home treat episodes and assert outreach. This creates the visualization and helps understand the large amount of data in a single figure.

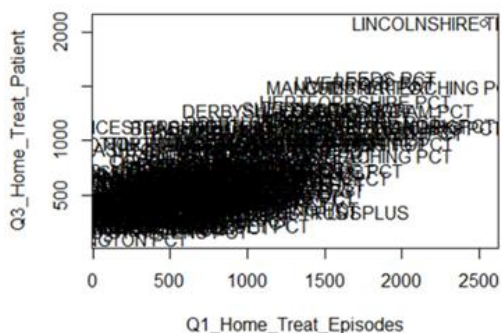


Figure 2

This scatterplot shows the relationship between the number of patients treated at home and the number of episodes treated at home

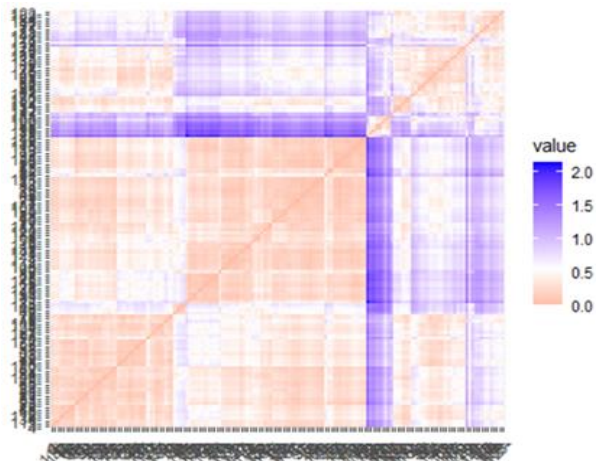


Figure 3 - Correlation plot

The fviz dist () function is the Simple way to visualize distance matrices. This function is a part of the factoextra package in R, and it is used to create graphical representations of distance matrices. Specifically, it is used to visualize the distances between observations or variables. The red color indicates the high similarity and blue color indicates the low similarity. The color level is proportional to the value of dissimilarity between observations where pure red represents zero and pure blue represents one.

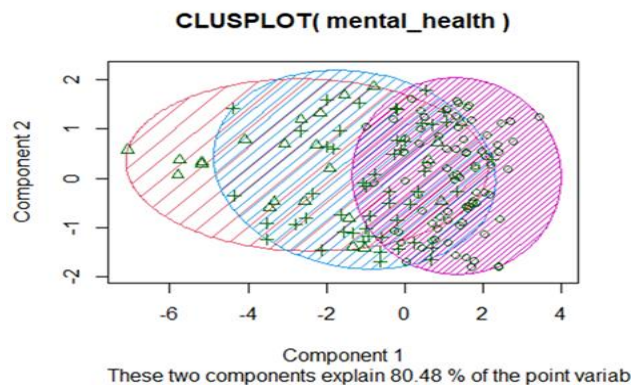


Figure 4 – Cluster Plot

The clustplot() function is used to create the plot. The clusplot() function in R is used to create a scatter plot matrix that visualizes the results of a clustering analysis. It is part of the cluster package in R. This is useful tool for exploring the results of a clustering analysis and identifying any patterns or trends in the data.

Above plot represented the K means clustering. We use K=3 therefore above figure shows the three clusters. These three cluster sets connect with each clusters therefore there having a strong relationship.

## VI. CONCLUSION

K means clustering is one of the most widely used clustering algorithms. Also in our case, k -means Cluster analysis was the most appropriate. Clustering can be a useful tool for identifying patterns in mental health data and improving our understanding of mental health problems. We were able to identify significant clusters. Clustering can be a valuable tool for mental health research when used responsibly and ethically. It can help identify subgroups of individuals with similar symptoms or risk factors, which can lead to more targeted and effective interventions. We were able to get a sense of similar mental illness patients and what they had in common attributes after analyzing those clusters. Relevant parties can then treat them according to their similarities.

As a result of a considerable portion of the general population experiencing mental health issues at home point in their lives, mental health is a growingly important issue in the UK. As there have been more reports of anxiety, depression and other mental health problems in the general public due to the COVID-19 epidemic, it has become even more important that mental health is. The UK government has made efforts to enhance mental health services and assistance because it understands the significance of mental health. To address the difficulties and obstacles that people seeking mental health help, particularly those from marginalized populations, experience however much needs to be done. According to research promoting mental health and wellbeing requires early intervention, prevention and access to mental health services. To reduce stigma and increase awareness of mental health issues, it is crucial to keep finding mental health services and assistance.

## VII. FUTURE WORK

Learning k-means cluster analysis by trying to solve problems such as healthcare, economy etc. Expecting to use k-means cluster analysis for the real-world problem. And Can Estimate future fertility rates in the UK based on present trends and patterns.

K-means clustering can be used to identify patient groups with similar treatment outcomes, which can help healthcare providers personalize treatment plans for individual patients. And also can be used to identify high-risk patient groups based on demographics, medical history, and other factors. This can help healthcare providers target preventive interventions to those who need it most.

Increased focus on prevention. This may involve strategies such as early intervention for young people, promoting good mental health in workplaces, and addressing social determinants of mental health. And can use more innovative treatments to treat.

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