Journal of Business and Technology

Volume 4 | Number 1 & 2 | January & July 2020

Department of Commerce and Financial Management
Faculty of Commerce and Management Studies
University of Kelaniya

Journal of Business and Technology

Journal of Business and Technology which is published semi-annually is the journal of the Department of Commerce and Financial Management. The vision of the journal is to offer an academic platform to local and international authors to publish their novel empirical and high-quality research works. It proposes to encourage research connecting to modern trends and practices in finance, entrepreneurship, human resource management, marketing and emerging paradigms in related areas of management including social sciences, education and information, and technology. As a journal with a broad disciplinary readership, the journal aims to publish papers accessible to this readership.

Journal of Business and Technology is a by annual journal, but the Editorial Board decided to release the number 1 and 2 of volume for (2020 Vol.4 (1/2)) as a single publication due to the difficulties caused by the COVID 19 pandemic situation.

Editorial Advisory Board

Editor in Chief

Journal of Business and Technology

ISSN 2738-2028 (Online) | Vol. 4 | No. 1 & 2 | 2020 January

JBT

Journal of Business and Technology

International peer-reviewed journal | Publish semi-annually

Conceptualizing the Impact of AI and Automation on Leadership, Human Capital and Organizational Performance

D. Thillaivasan [1*] and C. N. Wickramasinghe [2]

[1] Faculty of Commerce and Management Studies, University of Kelaniya, Sri Lanka,
[2] Department of Commerce and Financial Management, University of Kelaniya, Sri Lanka
[*] Corresponding Author; dhushy@DH3S.com

ABSTRACT

Humanity is at the brink of the Fourth Industrial Revolution which is poised to change businesses, industries and societies. While there is plethora of technologies on offer, Artificial Intelligence (AI) is touted as the most disruptive technology of them all as AI will have deeper and broader impact on businesses, workforce and on industries at large. Transformational leaders envision the possibilities of performance improvements via AI technology and developing the strategies to digital transformation. However, this paper aims to conceptualize the novel impact of the digital transformation in terms of AI and automation on organizational performance by scrutinizing the impact of AI on two key elements, to transform the leadership and human capital, that are used by all organizations in their performance measurement approaches and models. Our investigation was conducted by way of an extensive literature review and found significant implication on factors selected. The investigation also revealed that AI and automation will also have significant implications on the configuration of the future organization. Considering these implications, we postulate that organizational performance metrics of today need to evolve significantly to measure performance of future organization.

Keywords: Artificial Intelligence (AI), Automation, Human Capital, Leadership, Organizational Performance.

INTRODUCTION

Throughout history, the adoption of technology, from fire to steel, has transformed humanity and have helped build nations and empires (Diamond, 1997; Harari, 2014; Vince, 2019). Evidence shows that countries that have embraced technologies and industrialized have gained power and prosperity since the First Industrial Revolution and have lifted millions of people out of poverty (Crafts, 1989; Diamond, 1997; Engerman & O'Brien, 2004; Kniivilä, 2007; Macon-Cooney, 2019). Today these countries are ranked at the top in most aspects of economic, political, social and technological development and are generally identified as the modern world (Diamond, 1997; Macon-Cooney, 2019) showing that technology adoption is key for growth and economic prosperity. Since the First Industrial Revolution, as an integral aspect of a country's economy, business organizations have also adopted technologies to enhance their productivity and performance.

Today, humanity is facing a technological revolutions that will fundamentally alter our lives, work and the way we relate to each other in a scale and scope that have never been seen before (Schwab, 2016). Amongst the emerging technologies of today, Artificial Intelligence (AI) has been identified as the biggest

disrupting force and the business organizations that are slow to embrace AI may risk extinction (Raj & Seamans, 2019).

While the benefits of AI to human society and business organizations are vast, past experiences show that adoption of new technologies by business organization has not always proven a linear positive relation resulting high performance and productivity (Brynjolfsson et al., 2017) also known as the productivity paradox (Brynjolfsson et al., 2017). In most cases where technology adaptation and transformation has not delivered the expected results, there has been unrealistic expectations on technology capabilities Borup et al., 2006). Hence it is critical for organization to understand the true potential and impact of AI and other frontier technologies and to be prepared to transform themselves to reap the expected benefits (Raj & Seamans, 2019; Saldanha, 2019).

Performance is an ultimate measure of success for organizations, since its only through performance organization can achieve sustainable growth (Gavrea et al., 2011). Since measuring organizational performance involves multiple variables, there are no universally accepted organizational performance management metrices. As technology impact on organizational performance are highly influence by the sociological expectations rather than the technical expectations (Borup et al., 2006), future organizational performance measurement metrices should take into account the impact of AI and other frontier technologies on leadership and human capital. leadership could be defined simply as the art of influencing people so that they will strive willingly towards the achievement of group goals.

Leadership plays a critical role between the organization and the individual employees and it influences the intensity of collaboration between the employees and the organization. (Timothy et al., 2011). As the key decision makers, leaders determine the acquisition, development, and deployment of organizational resources and the conversion of these resources into products and services, and the delivery of value to organizational stakeholders. Hence, they are also the sources of sustained competitive advantage of the organization (Madanchian et al., 2016). Technology has significant impact on leadership and has been the catalyst for many of the existing leadership theories since the First Industrial Revolution (Björkman & Johansson, 2017; Brynjolfsson & McAfee, 2016). With the adoption of technology todays workplaces are becoming more collaborative and team-based, where cognitive and social skills are valued, and the approach to understanding leadership in the workplace is moving away from the classical leadership ontology, with clearly defined leaders, followers and shared goals towards collectivistic leadership approaches that looks at leadership as a process of shared responsibilities and contribution. Shared leadership is one such approach, in which team members share responsibility for a set of roles and tasks, where leadership cannot be separated from the social context (Björkman & Johansson, 2017).

We are witnessing the transition from a production economy to a knowledge economy, and there has been a paradigm shift in the way ‘assets’ are viewed within organizations. From a strategic management perspective, physical resources confer little advantage to organizations because they can be bought and sold on the open market with ease (McCracken et al., 2017). In a knowledge economy, it is the competence (intangible abilities and skills) of the workforce or Human Capital and the knowledge inherent within the organization’s structures, routines, systems and processes which can contribute towards the knowledge capital of the organization. Human Capital not only plays a vital role in developing and creating new ideas and knowledge, it also facilitates social capital and the sharing of knowledge and ideas through internal relationships and complements a firm’s structural and innovation capital by creating

new and unique knowledge (McCracken et al., 2017).

The digital transformation process that the world is undergoing at present is transformative compared to any previous technology disruptions. AI and Automation will enable us to infer and understand the world form a whole new perspective which will have significant impact on our present undressing of what is leadership and the role of human capital. This concept paper aims to analyze the impact AI and Automation on two key factors of organizational performance, leadership and human capital, and elaborates how this could influence future organizational performance measurement metrices. This paper aims to inquire, (1) what is the impact of AI on transforming leadership and human capital? And (2) How would this influence the organizational performance measurement metrices? Theoretical argument to this inquiry was developed based on extensive review and analysis of existing literature.

LITERATURE REVIEW

Continuum of Industrial Revolutions

The cognitive revolution and the emergence of fictive language 70,000 was the first revolution of homo sapiens (humans) followed by the agriculture revolution12,000 years ago where humans began to domesticate plant and animals. (Diamond, 1997; Harari, 2014; Vince, 2019). The agriculture revolution paved the way for permanent settlement of humans and gave rise to the first kingdoms, scripts and money amongst other things (Diamond, 1997; Harari, 2014; Vince, 2019). During this period human societies were powered by human and animal muscle limiting the ability of growth.

The First Industrial Revolution which began in 1784's saw the rise of mechanization using water and steam and began replacing muscle power with steam power. The Second which began in 1870's used electric power to create mass production, invention of the internal combustion engine and saw the rise of cities and our modern education system. The Third which began in 1969 used electronics and

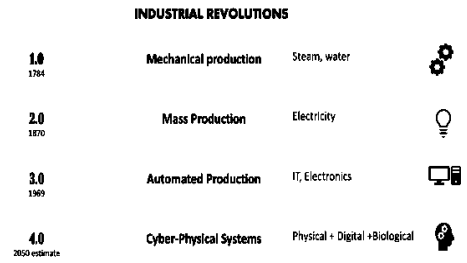


Figure 1: Industrial Revolutions. From Foreign Affairs. *Retrieved from https://www.foreignaffairs.com/articles/2015-12-12/fourth-industrial-revolution. Copyright 2015 by Klaus Schwab.*

information technology to automate production and gave rise digitization. Today a Fourth Industrial Revolution is being unraveled which is built on the Third. It is characterized by a fusion of technologies that is blurring the lines between the physical, digital, and biological spheres (Schwab, 2016; Xu et al., 2018). According to Schwab (2016),

> *"We are at the beginning of a revolution that is fundamentally changing the way we live, work, and relate to one another. In its scale, scope and complexity, what I consider to be the fourth industrial revolution is unlike anything humankind has experienced before".*

Cyber-Physical Systems

The fourth industrial revolution goes far beyond manufacturing, automation and digitization of information. Today's technologies are advancing to a state where we are now capable of deconstructing and reproducing even biological matters. Today we are able to blur the boundaries between physical, digital and the biological worlds and create a new world of cyber physical systems (Schwab, 2016).

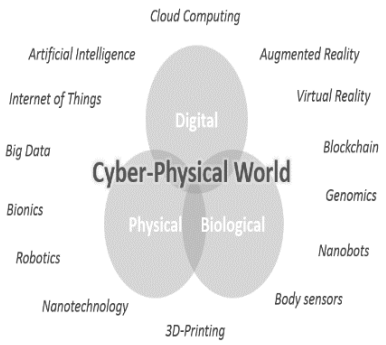


Figure 2 : Cyber Physical World. From Silicon Valley Innovation Center. Retrieved from *https://svicenter.com/the-fourth-industrial-revolution-is-here-is-your-business-ready/. Copyright 2017 by Silicon Valley Innovation Center.*

The reason for such a dramatic change which has not been seen during the past industrial revolutions is the velocity, scope and system impact of the current revolution (Schwab, 2016; Xu et al., 2018). A huge wave of emerging technologies such as Artificial Intelligence, Robotics, Virtual Reality, Nanotechnology, 3D Printing to name a few, are integrating with one another combining to deliver higher value than they could on their own (Xu et al., 2018; Zhulenev A, 2018). The breadth and depth of these changes are poised to transform the entire system of production, management and governance. However, concerns have also been raised that humans may eventually lose their economic and military usefulness and the economic and political systems may not value to them in the future (Harari, 2016).

Emergence of Artificial Intelligence

Among all the emerging technologies Artificial Intelligence (AI) is by far the most important and disruptive (Rana et al., 2017; Zhulenev, 2017) as well as transformative (Hong et al., 2017). The field of AI as a science existed since 1956 but the last few years have witnessed significant breakthroughs. AI powered image-recognition software can now match human vision capabilities and Natural Language Processing (NLP) is now on par with human-level language comprehension (Raj & Seamans, 2019; Hong et al., 2017; Zhulenev, 2017). Traditionally humans were considered to have two types of abilities physical and cognitive and in the past machines were created to support or replace humans physical abilities while humans still retained an immense edge of cognitive abilities (Harari, 2019). However as we develop powerful AI, humans are separating intelligence and conciseness, which we considered as cognition, and parting intelligence to machines which will have major implications to humanity as a whole (Harari, 2019).

AI can be broadly categorized into General Artificial Intelligence and Narrow Artificial intelligences where General AI referrers to the ability of the ability of the system to think and act on its own and Narrow AI referrers to systems the relies on highly sophisticated algorithmic techniques to find patterns in data and make predictions. Narrow AI is also referred to as machine learning as the system learns from existing data (Raj & Seamans, 2019). While General AI does not currently exist, we have already started using some Narrow AI applications to supplement our cognitive and administrative capabilities (Zhulenev, 2017; Raj & Seamans, 2019).

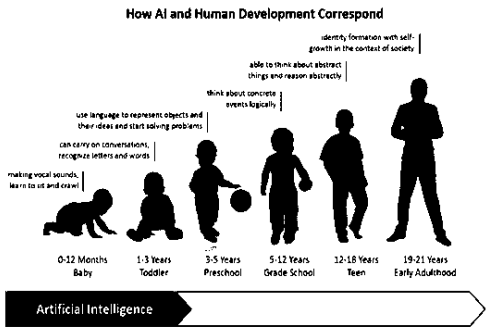


Figure 3 : AI and Human Development Correspondence. From Silicon Valley Innovation Center. *Retrieved from https://svicenter.com/the-fourth-industrial-revolution-is-here-is-your-business-ready/. Copyright 2017 by Silicon Valley Innovation Center.*

Personal assistant tools and chatbots are capable of holding a simple conversation which corresponds to a toddler today and they keep improving day by day (Zhulenev, 2017). Figure #3 below depicts the potential growth path of AI into the future, from Narrow AI to General AI.

Today, machine learning focuses on prediction and estimation of the unknown based on a set of given data and there are a variety of algorithms that are used in machine learning. While some of these algorithms are based on logit models others involve neural networks which are sophisticated algorithms that tries to mimic the human brain on how the brain looks for patterns in data (Raj & Seamans, 2019).

Impact of Artificial Intelligence on Business Organizations

The process of automation started with the First Industrial Revolution as the steam engine and the cotton gin automated some of the previously manual tasks (Frey & Osborne, 2017; Raj & Seamans, 2019). While AI, Robotics and Automation are related concepts they are different to one another. Robotics is technology that is used to automate physical tasks and AI is more about computer-based learning than physical manipulation. However, increasingly these two technologies are being combined to create smarter technologies that can go beyond performing physical tasks and continuously learn from themselves (Frey & Osborne, 2017; Raj & Seamans, 2019).

While in the past automation impacted industries with physical labor such as manufacturing and agriculture, today AI based automation is disrupting knowledge work and services industries such as banking, finance and healthcare. With the combination of AI and robotics, also known as smart automation, the disruption would be felt across multiple industries including manufacturing and transport and its seems that no industry would be spared (Frey & Osborne, 2017; Hawksworth et al., 2018).

Table 1: Key differences between automation and AI

Types of Automation and AI		What they can do	
Robotic process automation		Repetitive; Rule-based work.	
Artificial Intelligence (AI)	Applied AI	Judgement based processing	"Thinking"
	General AI, machine learning		"Learning"; improves over time. Example: natural language processing to understand human communication.
	Synthetic, computer based ("runaway") AI	Decision-making; learning; doing; independent creation and improvement of AI without a need for human intervention.	

Note. Adopted from "The impact of the technological revolution on labor markets and income distribution" by Hong et al. 2017. Copyright 2017 by United Nations.

The Interplay between Technology and Humans

The theory of Social Construction of Technology (SCOT) holds that human action shape technology (Bijker et al., 1987) and technology is inextricably bound with social conditions (Yousefikhah, 2017). This view is contrast to technology determinism which argues that technology shapes human action (Campbell & Russo, 2003; Jaeger, 2001; Yousefikhah, 2017). Technology determinisms holds that technology exists and waiting to be found by humans and once found it will become the driving force of the society (Campbell & Russo, 2003; Jaeger, 2001). While there are a multiple social constructionist views generally all of them have a few things in common. They deny technological determinism, they recognize the interplay and interdependence between social and technological elements (Jackson et al., 2019). They also deny that technologies are

ever complete and they redirect attention form product to process (Jackson et al., 2019) which is a contradiction to SCOT.

Social constructionist inquiries have made a number of contributions to the understanding of the process by which technology and organizations interact that has resulted in the emphasis of co-construction of organization and technology. Like technology, organization are never complete as they continue to interact and reshape each other (Jackson et al., 2019). Technology enables many tasks to move from action centered to intellective which has forced workers to develop certain level of abstraction about the task they perform which intern enables to reconceptualize, restructure and improve their work. The use of technology to informate work as opposed to automation has had profound impact on organizational performance (Jackson et al., 2019).

Today, technology forms the core of the organization as organization become increasingly technology centric. The influence of technology in enabling employees of further abstraction of their task resulting in high productivity and innovation which cannot be ignored. A key feature of the future organization is the adoption and use of exponential technologies such as AI at its core and the influence of these technologies on leadership, human capital, customers and community will be profound. Understanding the technology – human interplay would be a critical aspect in determining performance of future organizations.

Growth of an Organization

Organizational growth is a complex phenomenon as it is not unidimensional since it could be conceptualized and measured in many different ways and it is hard to predict and assess. Further, it can manifest itself in various ways, and consequently it can have differential effects on several different levels (Naldi et al., 2010). The phenomenon of growth is used with two different discourses; growth as an (1) increase in amount (output, sales, export, etc.) which is an absolute measure and as an (2) internal process of development (increase in size, improvement in quality, etc.) which is a relative measure. While the dominant measure of growth in general is increase in amount and studied quantitatively, the relative measures are generally studied qualitatively (Naldi et al., 2010).

The Unicist theory of business growth establishes the conditions that need to be given and the actions that need to be developed to promote growth in businesses. It further emphasis on the limits that are given by the available resources and by the archetypes of cultures and institutions (Belohlavek, 2015). According to the Unicist theory, there are two simultaneous actions that need to be developed to make a business grow, (1) conjunctural actions that seize advantage of opportunities and (2) structural actions to develop the structural growth of a business. The process is approached considering (1) the context for growth, (2) the critical mass for growth and (3) the operation for growth (Belohlavek, 2015). Structural actions which are taken to develop the structural growth of a business entails the optimization of technology adoption by leadership and human capital for business growth. Considering the centrality of technology in current and future organizations, understanding the impact of technologies such as AI on leadership and human capital is critical to comprehend the growth of future organizations.

Organizational Performance

Organization performance is based on the idea that an organizations is a voluntary collection of productive resources which includes humans, physical and capital resources for the purpose of achieving a shared objective (Carton, 2004). Organization performance can also be described as the relationship between minimal and effective cost, effective cost and realized output and output and achieved outcome (Shafiu et al., 2019). The idea of measuring performance of an organization is to give its stakeholder a view of the organization.

As the model of business and technology evolves, so does the need for information requirement to understand the organization (Kuske & Zander, 2004). Performance of an organization is vital as its only though performance an organization is able to grow and expand making performance a key indicator of organizational progress (Gavrea et al., 2011).

While the concept of organizational performance is common in academic literature, there is no clear definition of what organizational performance is since very few studies have corroborated consistent definitions and measures (Constantinos et al., 2014; Gavrea et al., 2011; Richard et al., 2009), hence there are multiple views could be found based on different authors perspectives. Since organizational performance can be measured using multiple aspects, which results in different interpretation of what is successful performance, each of these measures of organizational performance can also be considered unique. Moreover, every organization operates in its own unique environment making performance measurement inherently situational as well as contextual (Carton, 2004). Performance of an organization is influenced by its external environment which includes its customers, competitors and suppliers and its internal environment which includes its strategy, leadership, employees, quality, performance measurement, innovation, technology and corporate governance (Gavrea et al., 2011).

Measuring Organizational Performance

Performance can be explained as set of financial and non-financial indicators that informs the degree of achievement of objectives and results. Since performance is dynamic it requires judgement and interpretation. Performance could also be explained by a causal model which examines how current action may affect future results. It is also necessary to understand the multiple elements that are involved and their characteristics and the areas of impact. The ability to quantify results is key for understanding organizational performance (Gavrea et al., 2011). According to Bourne & Neely, (2003), performance measurement means the following when referred to in literature and practice: (1) a set of multi-dimensional performance measures (financial/non-financial and internal/external) that quantify performance achieved and helps in forecasting future performance; (2) performance measurement required a reference framework against which the results of action can be judged. This framework is presently accepted as organization's strategy; (3) performance measure has an impact on the environment it operates. It is an integral part of part of management planning and control system as it influences the behavior of individuals and groups that are being measured; (4) performance measurement also involves assessing the impact on stakeholders whose performance is being measured. Performance might be understood differently by the different stakeholders of an organization making it subjective (Carton, 2004; Gavrea et al., 2011).

Up until the 1990's financial measures played a key role in measuring organizational performance. However, the understanding of the limitation of unidimensional financial measure triggered the move towards an integrated and multidimensional measurement approach after the 1990's. The introduction of multidimensional and interconnected variables for organizational performance measurement also bought in the idea of objective and subjective measures. Accounting measures, financial market measures and mixed accounting and financial market measures and survival measures are considered objective and other measures are considered subjective (Richard et al., 2009; Singh et al., 2016). Both objective and subjective measures are used together as the subjective measures enables the managers to factor in the objectives of the organization when evaluating their performance (Singh et al., 2016).

Today every approach and model for organizational performance measurement involves leadership and human capital as two key subjective variables amongst others, showing the significant impact these variables will have on overall organizational performance.

Table 2 : Comparison of traditional and non-traditional performance measures

Traditional performance measures	**Non-traditional performance measures**
Based on outdated traditional accounting system	Based on company strategy
Mainly financial measures	Mainly non-financial measures
Intended for middle and high mangers	Intended for all employees
Lagging matrices (weekly or monthly)	On-time metrices (hourly or daily)
Difficult, confusing and misleading	Simple, accurate and easy to use
Lead to employee frustration	Lead to employee satisfaction
Neglected at the shop floor	Frequently used at the shop floor
Have a fixed format	Have no fixed format (depends on need)
Do not vary between locations	Vary between locations
Do not change over time	Change over time as the need changes
Intended mainly for monitoring performance	Intended to improve performance
Not applicable for JIT, TQM, CIM, FMS, RPR, OPT, etc.	Applicable
Hinders continuous improvement	Help in achieving continuous improvement

Note. Adopted from "Understanding Performance Measurement Through the Literature" by Khan & Shah, 2011, African journal of business management 5(35), pp 13413. Copyright 2011 by African journal of business management.

Influence of Leadership and Human Capital on Organizational Performance

Leadership and Organizational Performance

Leadership is an element that is often cited in organization performance literature as well as a key subjective variable in all the organizational performance measurement models. Leadership has a direct impact on the organizational profitability, share prices and it has been described as the key element that ensures connectivity between all the success factors of an organization (Gavrea et al., 2011).

When an effective leadership that involves motivation, management, inspiration, remuneration and analytical skills is present in an organization, the organization records increased employee satisfaction which has a positive effect on productivity and profit (Shafiu et al., 2019). A leader must have the ability to promote creativity and innovation and inspire his team to challenge their own value system to improve their performance, thus the style of leadership plays a significant role (Shafiu et al., 2019). Leadership style also has a direct influence in the organizational culture which in turn influences organizational performance (Al Khajeh, 2018).

Human Capital and Organizational Performance

Human capital is another key subjective element that has been reflected in all the organizational performance diagnostic models emphasizing the criticality of this variable. Poor employee engagement has a direct influence on organizational performance. (Gavrea et al., 2011). As human capital is characterized by the highest degree of restraint, attracting and retaining quality employees becomes a critical issue for competitive advantage and organizational performance. Studies have also shown the direct correlation between employee turnover and profitability of an organization (Gavrea et al., 2011).

Some scholars have also attributed organizational performance to employee job satisfaction and employee effective commitment (Shafiu et al., 2019). While employee performance depends on many factors' motivation, job satisfaction, training and development, employee motivation is considered critical as it has been shown to influence the overall organizational performance to a significant degree. It has been proposed that a motivated employee will generally have their goals aligned with the organizational goals thus contributing significantly to the organization performance (Dobre, 2018).

Training and development of employees is another critical aspect in improving organizational performance. Employee development is a process where the employee is trained by the organization to learn, acquire and update knowledge and skills (Kenny, 2019). Employee development tends to be a joint initiative of the employee and the organization to enhance existing skills and knowledge of the employee and enrich competency by training and development (Kenny, 2019).

Conceptualizing the Impact of AI on Leadership, Human Capital and Organizational Performance

Potential Impact of AI and Automation on Organization

The rapid advances in Artificial intelligence (AI), robotics and other forms of smart automation have the potential to deliver great benefits to the world economy by boosting productivity, creating new and improved products and services (Hawksworth et al., 2018; Hong et al., 2017). By 2030 these technologies are expected to contribute up to 14% of global GDP which is equivalent to US$ 15 trillion at today's value (Hawksworth et al., 2018). However these technologies also have the potential to cause significant disruption to whole industries, job markets, organizations and governance structures (Frey & Osborne, 2017; Harari, 2016; Hawksworth et al., 2018; Kolbjornsrud, 2016).

A study published by Hawksworth et al. (2018) argues that there are large benefits to be reaped by business in all sectors and identify how this process might unfold over the period to the 2030's in three different overlapping waves of automation as shown in Figure 4.

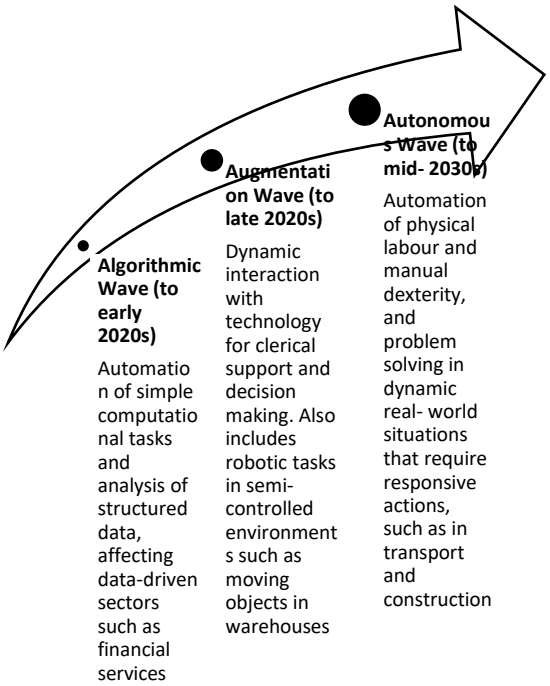


Figure 4 : Waves of Automation. Adopted from "Will robots really steal our jobs? An international analysis of the potential long-term impact of automation" *by Hawksworth et al. 2018. Copyright 2018 by Price Water House.*

As described by Hawksworth et al. (2018), (1) Algorithm wave, which is already underway, is focused on automation of simple computational tasks and analysis of structured data in areas like finance, information and communications. (2) Augmentation wave, which is also underway but will reach maturity in 2020's, is focused on automation of repeatable tasks such as filling in forms, communicating and exchanging information through dynamic technological support, and

statistical analysis of unstructured data in semi-controlled environments such as aerial drones and robots in warehouses. (3) Autonomous wave, where technologies are under development at present and will reach full maturity by 2030's, is focused on automation of physical labour and manual dexterity, and problem solving in dynamic real-world situations that require responsive actions, such as in manufacturing and transport (e.g., driverless vehicles).

Table 3: Key impacts in the three waves of automation

Phase	Description	Tasks Impacted	Industries Impacted
Algorithm wave	Automation of simple computational tasks and analysis of structured data, affecting data-driven sectors such as financial services.	This includes manually conducting mathematical calculations, or using basic software packages and internet searches. Despite increasingly sophisticated machine learning algorithms being available and increasingly commoditised, it is these more fundamental computational job tasks that will be most impacted first.	Data driven sectors li financial and insuranc information a communication, a professional, scientif and technical services.
Augmentation wave	Automation of physical labour and manual dexterity, and problem solving in dynamic real-world situations that require responsive actions, such as in transport and manufacturing.	For example, routine tasks such as filling in forms or exchanging information, which includes the physical transfer of information. It is also likely to see a decreased need for many programming languages as repeatable programmable tasks are increasingly automated, and through machines themselves building and redesigning learning algorithms.	The financial a insurance sector w continue to be high impacted, along wi other sectors with higher proportion clerical suppo including public a administration, manufacturing, a transport and storage.
Autonomy wave	Automation of physical labour and manual dexterity, and problem solving in dynamic real-world situations that require responsive actions, such as in transport and manufacturing.	AI and robotics will further automate routine tasks but also those tasks that involve physical labour or manual dexterity. This will include the simulation of adaptive behaviour by autonomous agents.	Sectors like constructio water, sewage and was management, a transportation a storage with the adve of fully autonomo vehicles and robots.

Note. Adopted from "Will robots really steal our jobs? An international analysis of the potential long-term impact of automation" *by Hawksworth et al. 2018. Copyright 2018 by Price Water House.*

As shown in Table 3, by 2030 the different waves of automation will have an impact across multiple tasks and across multiple industries.

Whether organizations and their leadership are ready to face the automation waves is another question. A study by Deloitte (2018), found that while corporate executives have a broader understanding of the automation challenges ahead of them, they acknowledge their lack of readiness to harness the future as they are still focused on tradition business strategies. They also lack confidence with their workforce and face challenges with investments into advanced technology.

Potential Impact of AI and Automation on Leadership

Unlike the previous of automations which largely disrupted blue color and repetitive service jobs, recent advancement in AI and smart automation will also disrupt all levels of management in an organization, from strategic level to the frontline. Leaders and managers will have to reconsider their roles and will be forced to reconsider the basic principles they apply in managing their organizations and employees (Brynjolfsson & McAfee, 2016; Chamorro-Premuzic et al., 2018; Kolbjornsrud et al., 2016; Leurent et al., 2019).

As organizations begin to rely more on technology, the workplace will become more collaborative moving away from division of labor of today's workplace and the collaboration between humans and machines. Cognitive and social skills will be more valued the approach to leadership will move towards a collective leadership style where leadership will be a process of shared responsibilities and contribution. They also emphasize that all leaders and managers will have to place humans at the center and follow a people first strategy and their primary task will be enabling employees (Björkman & Johansson, 2017; Brynjolfsson & McAfee, 2016; Kolbjornsrud et al., 2016; Leurent et al., 2019). Figure 5 is a pictorial representation of the leadership style and supporting behavior of the future leader.

Figure 5 : Leadership in the Fourth Industrial Revolution: Six dimensions of leadership and supporting behaviors. Adopted from "Leading through the Fourth Industrial Revolution Putting People at the Centre*" by Leurent et al. (2019). Copyright 2018 by World Economic Forum.*

Administrative management tasks (Hard elements of leadership) performed by todays managers such as coordination and control will be replaced by AI and the future mangers will thrive on judgment work (Soft elements of leadership), which will require them to develop new skills and mindsets. Future managers will also have to learn to treat intelligence machines as collogues, learn to collaborate digitally across boundaries and also work like a designer using their creative abilities (Brynjolfsson & McAfee, 2016; Chamorro-Premuzic et al., 2018; Kolbjornsrud et al., 2016). Judgement work, according to Kolbjornsrud et al. (2016), which they consider as the human advantage will require, considerable degree of creative and social intelligence, whether related to people development, problem solving or strategizing and innovation as shown in Figure 6.

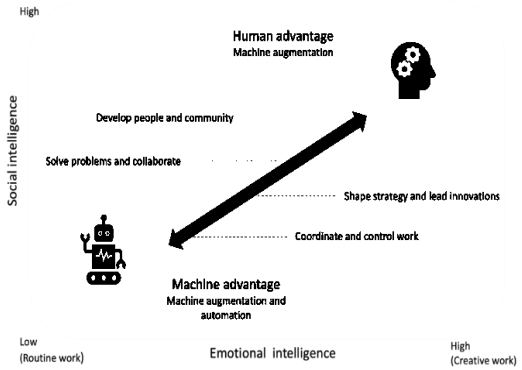


Figure 6 : Judgement Work: The Human Advantage. Adopted from "The promise of artificial intelligence Redefining management in the workforce of the future" *by Kolbjornsrud et al., 2016. Copyright 2018 by Accenture.*

The use of AI will vastly impact decision making at all levels of management. The ability of AI to collect and interpret vast amount of data from inside and outside the company which would have been challenging to organize and analyze, can be discovered, structured and analyzed for better decision and in many cases AI systems will be able to make decision on their own. AI does not have cognitive predispositions, making it possible to build an answer free from subjective ideas AI avoids being impacted by culture or religion in decision-making processes (Björkman & Johansson, 2017). While it is evident that AI and automation are going to bring fundamental changes to management and leadership, there is both resistance and readiness in the managerial ranks depending on their position and age. While strategic level leader and young managers are ready to embrace AI, middle level and older managers are skeptical about the promise of AI (Kolbjornsrud et al., 2016). It has also been observed that traditional organization are slow in their adoption of AI compared to their digital counterparts which could trigger a competitive imbalance in the

future (Deloitte, 2018; TATA Consultancy Services, 2016).

Another challenge is the understanding and functioning of AI system. Leaders, managers and generally all humans need to understand how AI works rather than follow the 'Blackbox' approach of today. There has to be good understanding what the AI system are capable of achieving and what type data they use. Organization and leaders should employ proper governance mechanisms and rules on how AI should be used in the respective organization (Björkman & Johansson, 2017). It is also necessary for leaders understand the constant technological changes of the future, learn and keep themselves abreast and behaving like entrepreneurs and innovators in their organizations to cope with the challenges (Björkman & Johansson, 2017).

Potential Impact of AI and Automation on Human Capital

Disruption to labor due to automation is hardly a phenomenon. The process of creative destruction throughout the course of history due to technological inventions from farming to industry, has been the source of wealth as well as disruption (Frey & Osborne, 2017). Fear of technological disruption and its effects on the labor market was felt during the early First Industrial Revolution when Queen Elizabet I refused to grant patents to William Lee's stocking frame knitting machine in 1589 (Frey & Osborne, 2017). Another example is Luddite movement of early 19th century where a group of English textile artisans protested against the automation of textile production (Autor, 2015).

Academic literature available today suggests that whenever technology causes disruption in the labor market, there will be a loss of 'jobs' but there will always be 'work' as the labor will get reskilled and move to others areas in the value creation process. These literature cite many examples from the artisans moving in to factory labor and electric automation giving rise to relatively skilled blue color workers and educated white color workers (Autor, 2015; Frey & Osborne, 2017; McKay et al., 2019; Vermeulen et al., 2018). An interesting phenomenon that could be observed in this literature is that, with the rise of computerization and computerized automation a number of repetitive tasks such as telephone operators were made redundant and lost to automation. The labor that was made redundant either skilled up and joined other high paying abstract jobs or moved down and joined low paying manual (physically adept) jobs, hollowing out the middle level routine jobs and polarizing the labor market (Autor, 2015; Frey & Osborne, 2017; McKay et al., 2019; Vermeulen et al., 2018). It has also been suggested the that job polarization has contributed towards the income polarization seen in the labor market today (Autor, 2015; Frey & Osborne, 2017).

To emphasize the important and defend the role of humans in an automated system, Autor (2015), has drawn a parallel between Michael Kremer's O-Ring production model and an automated value delivery process. He argues that as proposed by the O-Ring model of economic development, failure of any step in the chain of production leads to the failure of the entire production process, in an automated process where machines and algorithms makes some steps work more reliable, cheaper or faster, will increase the value of the remaining human link in the production chain. However, it is critical to understand that the AI revolution is not just about machines getting faster and smarter rather it is fueled by breakthroughs in life and social sciences which may challenge the role of humans in an organization in the future (Harari, 2019).

The ensuing automation revolution and societal transformation will create new forces and a new context shaping the world of work. Automation and digitalization will transform how work is done by substituting, augmenting and creating new tasks for workers. As tasks and jobs transform, the skills required by the workforce will also change, making skills of the future a critical need for workers and

employers alike (World Economic Forum, 2019). Organization will require new set of skills from their employees and will have to constantly reskill their employees to keep up with the pace of change. Companies such as Amazon who are at the frontier of automation have already understood the challenges and are investing on reskilling their workforce (Schuetz Molly, n.d.). Our present education systems are not geared to cater to the needs of the future workforce as most of the jobs of the future does not exist at present (Bayraktar & Ataç, 2018). With the rise of the gig economy and globalization organizations will operate over multiple geographies and will have distributed workforces and shift away from the traditional employee-employer relationships (World Economic Forum, 2019). Figure 7 depicts the forces that will influence the workforce of tomorrow.

Figure 7 : Forces shaping the future of work. Adopted from "HR4.0: Shaping People Strategies in the Fourth Industrial Revolution" *by World Economic Forum 2019. Copyright 201 by World Economic Forum.*

The function of Human Resource Management has evolved from being a Personnel Management function prior to the 1980's to a function that cumulates a range of strategic and tactical responsibility from talent management to business partnerships and shared operational services as organizations began focusing on the impact of people, motivation and engagement, as a critical differentiating factor in the race for success and sustainability. Human Resources Management would become core function of the future organization and would play a critical role in identifying the skill requirements by constantly scanning the environment and keep the workforce up to date.

As in the past, one of the key areas of concern today is how automation may disrupt the labor markets and contribute towards income inequality. There is widespread public anxiety that robots and AI will replace human jobs on a scale never seen before resulting in mass unemployment and underemployment causing widespread impoverishment (Harari, 2019; Hong et al., 2017; McKay et al., 2019). In addition today's business leaders lack confidence in their workforce to face the challenges of automation (Deloitte, 2018). Some scholars have predicted that with the current smart automation waves the jobs at risk in the US market could be as high as around 47% by 2030 while others have argued that this number could be as low as 10% (Hawksworth et al., 2018). It has also been observed that labor is also losing its share of income (Hong et al., 2017; McKay et al., 2019).

Potential Impact of AI, Automation and Organizational Performance

AI, smart automation and other frontier technologies are poised for deeper faster and broader and more disruptive forms of automation (McKay et al., 2019). They have the capability to enhance labour productivity enabling the organization to achieve more form the workforce, enable customization for the organization product or service offer thus creating good and services that are bespoke to individual customer needs, Improve quality of the product or service and expedite process making value delivery faster and reduce waste (Britton Benjamin, n.d.). Today, while AI is been used by some companies at the core of their business in many organizations AI is still at experimentation levels (TATA Consultancy Services, 2016). However, increasingly software driven products and process, an avalanche of data generated by the hyper

connected instruments, products and business processes and enormous data processing power at affordable costs are pushing AI to the centre stage and many organization have identified and understood the benefits and implication of AI (TATA Consultancy Services, 2016).

When industry switch from steam power to electric power, organizational performance did not increase instantly. The reason being that factories simply replaced steam power with electric power and did not change the production process. It took a few decades for the industries to reconfigure the production process to utilise electric power fully to extract better performance (Björkman & Johansson, 2017; Brynjolfsson & McAfee, 2016). The role of technology – human interplay in the changes and adoptions of process could not be understated during this era to reap the benefits of automation which is applicable to the future of automation as well. To extract high performance form AI and smart automation, organizations need to rethink their entire business model, value creation, value capture, value configuration and value delivery.

The three waves of automation which are under way now are poised to make fundamental changes to business organization and industries at large. Organization in their current configuration (shape and form) may not exist in the near future and some of these changes are already visible in organizations such as Amazon, Facebook and google who are considered to be Exponential Organizations (ExO) whose output is disproportionality large (at least 10X) compared to their peers because they employ new organizational techniques that leverages exponential technologies and these organization are considered as the organizations who will dominate the Fourth Industrial Revaluation (Ismail et al., 2014; Saldanha, 2019). A significant feature of these exponential organizations is that they work on the principal that resource are in abundance whereas the traditional organizations are built on the core principal of resource scarcity (Ismail et al., 2014; Saldanha, 2019).

The concept of organizational performance is based on the core principle of resource scarcity and this can be observed through the various definitions and the use of phrases such as efficiency, effectiveness and productivity. This assumption also means that an organization can only grow linearly. This is reflected in the performance measurement variables, models as well performance measurement systems that are being practised today. However, there is clear evidence that the organization of the Fourth Industrial Revolution, the Exponential Organizations, has a complete opposite view on resources and their growth would not be linear and many digitally native organizations such as Amazon, Google and Facebook are already showing these characteristics.

METHODOLOGY

Proposed Theoretical Framework

This paper focused on two key factors, leadership and human capital that are used in today's organization performance measurement metrices and discussed the disruptive changes they will undergo when AI and automation is adopted by organizations. The content and context of these elements of measure used in today's performance measurement models may not be applicable for the future organizations. Together with the changes to the configuration and construct of the future organization, one should question if the organizational performance measurement metrices of today is suitable to measure performance of the organizations of tomorrow or does it have to go through its next evolutionary wave?

Based on this study, the author proposes the following conceptual model (Figure 8) which also takes into account the human-technology interplay within an organization.

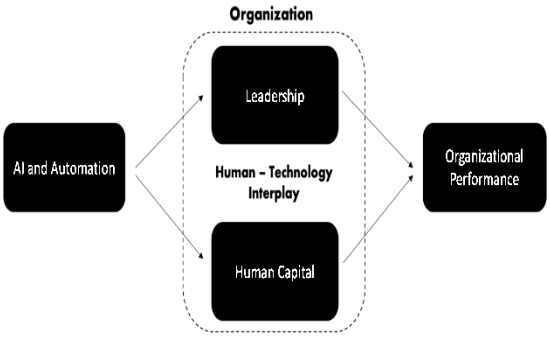


Figure 8 : The impact of AI and automation on organizational performance *based on authors conceptualization.*

FINDINGS AND DISCUSSION

AI is already surpassed human intelligence in the abstract gaming (BBC, 2019) and this trend is poised to continue into other aspects of human intelligence which will fundamentally change the role of humans in the value creation process of an organization.

This paper examines the implications of Artificial Intelligence on organizational performance with the dawn of the Fourth Industrial Revolutions. It focuses on two key subjective factors Leadership and Human Capital which is used in organizational performance measurement, and further probes into the impact of these two factors. It is also evident that there would be a significant impact on the construct of the organization. The implication of these changes suggests that the organizational performance metrices that are used today may not be suitable to measure organizational performance of the future organizations as it may have to evolve as well.

This inquiry also revealed that implementing AI, smart automation and other next generation technologies will also bring about new set of challenges to the organizations, involving privacy, data security and ethics as data becomes the core of the future organization. Challenges with regard to leadership, organizational culture and employee reskilling together with broader policy level implications in terms of education, employment and social security were also identified.

CONCLUSION AND FUTURE RESEARCH DIRECTIONS

While this study highlighted the implications on the selected organizational performance measurement variables, further research is required to understand the extend of these implications. Given the broad range and far-reaching consequences of these technologies and the implications they will have at policy and social levels, this is an area ripe for further research and studies.

REFERENCES

Al Khajeh, E. H. (2018). Leadership styles on organizational performance. *Journal of Human Reseources Management Research, 2018, 1*–10. https://doi.org/10.5171/2018.687849

Autor, D. H. (2015). Why are there still so many jobs? the history and future of workplace automation. *Journal of Economic Perspectives, 29(3),* 3–30. https://doi.org/10.1257/jep.29.3.3

Bayraktar, O., & Ataç, C. (2018). *Globalization, Institutions and Socio-Economic Performance*. Peter Lang.

BBC. (2019). *Go master quits because AI cannot be defeated.* Retrieved from BBC website: https://www.bbc.com/news/technology-50573071

Belohlavek, A. (2015). Conducting online focus groups on Facebook to inform health behavior change interventions: Two case studies and lessons learned. *Internet interventions, 9, 106*–111. https://doi.org/10.1016/j.invent.

Bijker, W. & Hughes, T. & Pinch, T. (1987). *The Social Construction of Technical*

Systems: New Directions in the Sociology and History of Technology.

Björkman, I., & Johansson, S. (2017). *What impact will Artificial Intelligence have on the future leadership role*? New Directions in Technology.

Borup, M., Brown, N., Konrad, K., & Van Lente, H. (2006). The sociology of expectations in science and technology. *Technology Analysis and Strategic Management, 18(3*–4), 285–298. https://doi.org/10.1080/09537320600777002

Bourne, M., & Neely, A. (2003). Implementing performance measurement systems:*A literature review. 5(1)*, 1–24. https://doi.org/10.1504/IJBPM.2003.002097

Britton B. (n.d.). *AI and the impact on the organisation*. Retrieved from Capgemini website: https://www.capgemini.com/gb-en/2019/08/ai-and-the-impact-on-the-organisation/

Brynjolfsson, E, McAfee, A. (2015) *The jobs that AI can't replace*. BBC, 13 September. Available (consulted 9 February 2016) at: http://www.bbc.co.uk/news/technology-34175290

Brynjolfsson, E., Rock, D., & Syverson, C. (2017). Artificial Intelligence and the Modern Productivity Paradox: *A Clash of Expectations and Statistics*. National Bureau of Economic Research.

Campbell, S. & Russo, T. (2003). The Social Construction of Mobile Telephony: An Application of the Social Influence Model to Perceptions and Uses of Mobile Phones within Personal Communication Networks. *Communication Monographs. 70.* 317-334. 10.1080/0363775032000179124.

Carton, R. (2004). Measuring Organizational Performance: *An Exploratory Study*. *11(2)*, 2–4.

Chamorro-Premuzic, Tomas & Swami, Viren & Cermakova, Blanka. (2018). Individual differences in music consumption are predicted by uses of music and age rather than emotional intelligence, neuroticism, extraversion or openness. *Psychology of Music. 40*. 285-300. 10.1177/0305735610381591.

Constantinos, S. J., Vicky, M., & Kalliopi, T. (2014). The ERP systems impact on business performance. *Proceedings of the European, Mediterranean and Middle Eastern Conference on Information Systems, EMCIS 2014*, 2014, 1–7.

Crafts, N. (1989). Trends and Cycles in British Industrial Production, 1700-1913. *Journal of the Royal Statistical Society. Series A (Statistics in Society), 152(1)*, 43-60. doi:10.2307/2982820

Deloitte. (2018). The fourth industrial revolution is here: Are you ready? *In Deloitte Insight*. https://doi.org/10.1016/j.jbusres.2015.10.029

Diamond, J. 1997. Guns, Germs and Steel. *A Short History of Everybody for the Last 13,000 Years*. 480 pp. London: Jonathan Cape. Price £18.99 (hard covers). ISBN 0 224 03809 5. Geological Magazine, 136(1), 83-108. doi:10.1017/S0016756899341777

Dobre, O.-I. (2018). Employee motivation and organizational performance. *Journal of Failure Analysis and Prevention, 18(5)*, 1286–1292. https://doi.org/10.1007/s11668-018-0520-7

Engerman, S., & O'Brien, P. (2004). The industrial revolution in global perspective. In R. Floud & P. Johnson (Eds.), *The Cambridge Economic History of Modern Britain (pp. 451-464).* Cambridge: Cambridge University Press. doi:10.1017/CHOL9780521820363.017

Frey, C. B., & Osborne, M. A. (2017). The future of employment: How susceptible are jobs to computerisation? *Technological Forecasting and Social*

Change, *114*, 254–280. https://doi.org/10.1016/j.techfore.2016.08.019

Gavrea C., Ilieş L., & Roxana, S. (2011). Determinants of Organizational Performance: the Case of Romania. Determinants of Organizational Performance: *The Case of Romania*, *6(2)*, 285–300.

Harari, Y. N. (2014). Sapiens. *A Brief Histroy of Humankind*. London: Penguin Random House UK.

Harari, Y. N. (2016). Homo Deus. *A Brief History of Tomorrow*. London: Penguin Random House UK.

Harari, Y. N. (2019). *21 Lessons for the 21st Century*. London: Penguin Random House UK.

Hawksworth, J., Berriman, R., & Goel, S. (2018). Will robots really steal our jobs?: An international analysis of the potential long term impact of automation. *Pricewaterhouse Coopers*, *1–47*. https://doi.org/10.1080/15374416.2013.822308

Hong, P., Alarcón, D., Bruckner, M., LaFleur, M., & Pitterle, I. (2017). *The impact of the technological revolution on labour markets and income distribution*. *6(2)*, 285

Ismail, S., Malone, M. S., Geest, Y. Van, & Diamandis, P. H. (2014). *Exponential Organizations : Why New Organizations are Ten Times Better, Faster, and Cheaper Than Yours (and What to Do About it)*. New York, USA: Diversion Books.

Jackson, J. C., Watts, J., Henry, T. R., List, J.-M., Forkel, R., Mucha, P. J., Greenhill, S. J., Gray, R. D., & Lindquist, K. A. (2019). *Emotion semantics show both cultural variation and universal structure*. *Science*, *366*(6472), 1517–1522. https://doi.org/10.1126/science.aaw8160

Jaeger, H. (2001). The" echo state" approach to analysing and training recurrent neural networks-with an erratum note'. *Bonn, Germany: German National Research Center for Information Technology GMD Technical Report.* 148.

Kenny, V. S. (2019). Employee Productivity And Organizational Performance: *A Theoretical Perspective. Munich Personal RePEc Archive*, *(April)*, *1*–11. https://doi.org/10.1142/9789812702920_0032

Khan, K., & Shah, A. (2011). Understanding performance measurement through the literature. *African Journal of Business Management*, *5*(35). https://doi.org/10.5897/ajbmx11.020

Kniivilä, M. (2007). Industrial development and economic growth: *Implications for poverty reduction and income inequality*. 9789812702920_0032

Kolbjornsrud, V., Amico, R., & Thomas, R. (2016). *The Promise of Artificial Intelligence: Redefining Management in the Workforce of the Future. Accenture Institute for High Performance and Accenture Strategy*, *1*–23. Retrieved from https://www.accenture.com/_acnmedia/PDF-32/AI_in_Management_Report.pdf%0Ahttp://0-search.proquest.com.catalog.lib.cmich.edu/docview/199816232?accountid=10181%5Cnhttp://sfxhosted.exlibrisgroup.com/cmich?url_ver=Z39.88-2004&rft_val_fmt=info:ofi/fmt:kev:mtx:

Kuske, K. J., & Zander, L. A. (2004). History of Business Performance Measurement. *Encyclopedia of Social Measurement*, *2*, 227–232. https://doi.org/10.1016/B0-12-369398-5/00473-4

Leurent, H., Betti, F., Shook, E., Fuchs, R., & Damrath, F. (2019). Leading through the fourth industrial revolution: Putting people at the centre. *World Economic Forum, (January)*, *1*–25.

Macon-Cooney, B. (2019). *The State and Technological Revolution | by Benedict*

Macon-Cooney - Project Syndicate. Retrieved from https://www.project-syndicate.org/commentary/technological-state-digital-revolution-by-benedict-macon-cooney-1-2019-12?barrier=accesspaylog

Madanchian, M., Hussein, N., Noordin, F., Taherdoost, H., & Group, H. (2016). *Effects of Leadership on Organizational Performance. (January).* 1748-8583

McCracken, M. & O'Kane, Paula & Brown, Travor & McCrory, Mark. (2017). Human resource business partner lifecycle model: exploring how the relationship between HRBPs and their line manager partners evolves over time. *Human Resource Management Journal. 27*. 58-74. 10.1111/1748-8583.12125.

McKay, C., Pollack, E., & Fitzpayne, A. (2019). *Automation and a Changing Economy Part II: Policies for Shared Prosperity*. (April). Retrieved from https://assets.aspeninstitute.org/content/uploads/2019/04/Automation-and-a-Changing-Economy_Policies-for-Shared-Prosperity_April-2019.pdf

Naldi, L., & Nordqvist, M., & Hellerstedt, K., & Wiklund, J. (2007). Entrepreneurial Orientation, Risk Taking, and Performance in Family Firms. *Family Business Review. 20*. 10.1111/j.1741-6248.2007.00082.x.

Raj, M., & Seamans, R. (2019). Primer on artificial intelligence and robotics. *Journal of Organization Design*, *8*(1), 11. https://doi.org/10.1186/s41469-019-0050-0

Rana, A., Srinivasan, A., Waral, J., Singh, M., Handrahan, S., & Noselli, C. (2017). *A new era: Artificial intelligence is now the biggest tech disrupter*. Retrieved December 9, 2019, from Bloomberg website: https://www.bloomberg.com/professional/blog/new-era-artificial-intelligence-now-biggest-tech-disrupter/

Richard, P. J., Devinney, T. M., Yip, G. S., & Johnson, G. (2009). Measuring organizational performance: Towards methodological best practice. *Journal of Management*, *35*(3), 718–804. https://doi.org/10.1177/0149206308330560

Saldanha, T. (2019). Why Digital Transformations Fail: *The Surprising Disciplines of How to Take Off and Stay Ahead*. Oakland, CA: Berrett-Koehler Publishers.

Schuetz Molly. (n.d.). *Amazon Worker Retraining Program 2019: Company to Spend $700* Mill. Retrieved December 13, 2019, from https://www.bloomberg.com/news/articles/2019-07-11/amazon-to-spend-700-million-retraining-a-third-of-u-s-workers

Schwab, K. (2016). The Fourth Industrial Revolution: what it means and how to respond. *World Economic Forum*, *1*–7. Retrieved from https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond/

Shafiu, A. M., Manaf, H. A., & Muslim, S. (2019). The impact of leadership on organizational performance. *International Journal of Recent Technology and Engineering*, *8*(3), 7573–7576. https://doi.org/10.35940/ijrte.c6158.098319

Singh, S., Darwish, T. K., & Potočnik, K. (2016). Measuring Organizational Performance: A Case for Subjective Measures. *British Journal of Management*, *27*(1), 214–224. https://doi.org/10.1111/1467-8551.12126

TATA Consultancy Services. (2016). *Getting Smarter by the Day: How AI is Elevating the Performance of Global Companies*. Retrieved from http://sites.tcs.com/artificial-intelligence/%5Cnhttp://sites.tcs.com/artificial-intelligence/#

Timothy, O., Okwu, A., Akpa, V., & Nwankwere, I. (2011). Effects of

Leadership Style on Organizational Performance: a Survey of Selected Small Scale Enterprises in Ikosi-Ketu Council Development Area of Lagos State, Nigeria. *Australian Journal of Business and Management Research, 1*(7), 100–111.

Vermeulen, B., Kesselhut, J., Pyka, A., & Saviotti, P. P. (2018). The impact of automation on employment: Just the usual structural change? *Sustainability (Switzerland), 10*(5), 1–27. https://doi.org/10.3390/su10051661

Vince, M. (2019). The 'migrant experience': An analytical discussion. *European Journal of Social Theory, 23*(4), 591–610. https://doi.org/10.1177/1368431019887290

World Economic Forum. (2019). HR4.0: *Shaping People Strategies in the Fourth Industrial Revolution. (December), 1*–38. Retrieved from https://www.weforum.org/reports/hr4-0-shaping-people-strategies-in-the-fourth-industrial-revolution

Xu, M., David, J. M., & Kim, S. H. (2018). The fourth industrial revolution: Opportunities and challenges. *International Journal of Financial Research, 9*(2), 90–95. https://doi.org/10.5430/ijfr.v9n2p90

Yousefikhah, S. (2017). Sociology of innovation: Social construction of technology perspective. *AD-minister. 31*-43. 10.17230/ad-minister.30.2.

Zhulenev A. (2018). The fourth industrial revolution is Africa's to lose. https://doi.org/10.6531/JFS.201809_23(1).0008

Zhulenev, A. (2017). The Fourth Industrial Revolution Is Here. Is Your Business Ready? Retrieved December 11, 2019, from https://svicenter.com/the-fourth-industrial-revolution-is-here-is-your-business-ready/

ISSN 2738-2028 (Online) | Vol. 4 | No. 1 & 2 | 2020 January & July

JBT

Journal of Business and Technology

International peer-reviewed journal | Publish semi-annually

Poverty Reduction Effect of Infrastructure: A Cross Country Study of Developing Countries in Asia

P. J. Atapattu[1*]

[1] Graduate School of International Development, University of Nagoya. Japan.
[*] Corresponding author: preethij@iuj.ac.jp

ABSTRACT

Poverty alleviation is the central theme of the decade and this paper investigates the poverty reduction effect of access to infrastructure using panel data from 1990-2015 for nine developing countries in Asia. The objective of the paper is to investigate the causality between poverty and access to infrastructure and to estimate the poverty reduction effect of infrastructure. Dependent variables are the poverty headcount ratio at USD 1.90 and USD 3.20 per day. A variable is created by using access to electricity, water and sanitation occupying principal component analysis (PCA). Causality test result indicates unidirectional causality running from access to infrastructure to poverty. The model estimated by using fixed effects and results find lack of access to electricity, water and sanitation are the major reasons to poverty. The poverty reduction effect of access to infrastructure is larger in the long-run. The results of the model speak to close infrastructure gap, make infrastructure accessible, make poor beneficiaries of education, to control persisting income inequality, controlling population growth, reduce unemployment and encourage remittance. Findings of the model guide policy makers to prioritize investment in infrastructure as infrastructure boosts human capital through better provisioning of electricity, sanitation and water and physical capital.

Keywords: *Electricity, Infrastructure, Poverty, Sanitation, Water.*

INTRODUCTION

Poverty alleviation is the central theme of Sustainable Development Goals (SDGs), and is the discussion of the decade. SDGs are closely connected with infrastructure as a source of reducing poverty through SDG Goal 9-Industry, Innovation, and Infrastructure, Goal 6-Clean water and sanitation, Goal 7-Affordable and clean energy, and Goal 11-Sustainable cities and communication connected to infrastructure (The Economist, 2019). The importance of infrastructure[1] in poverty[2] reduction is long cited relationship in the literature (UN, 2011). The percentage of poverty is 10.7%[3] out of the total world population, the total percentage of poor people dwelling in developing countries is 25% of the total population of developing countries. More than fifty percent of the extremely poor live in

[1] "Infrastructure includes all public services from law and order through education and public health to transportation, communication, power, water supply as well as agricultural overhead capital as irrigation and drainage systems" (Hirschman, 1958)

[2] "A condition characterized by severe deprivation of basic human needs, including food, safe drinking water, sanitation facilities, health, shelter, education, and information. It depends not only on income but also on access to services" (UNDP, 2019).

[3] The percentage of people living under US$ 1.90 per day

Sub Saharan African continent while South Asia is sheltering 13.5% of poor in 2015 out of total people in South Asia. Poverty reduction is a common goal and a global issue for decades, kept challenging as its multidirectional nature as finds in (JBIC, 2004), and capabilities of the poor must strengthen by fulfilling human capabilities.

Poverty in developing countries is comparatively high as majority of the people are incapable of access to infrastructure, "such as access to good schools, health care, electricity, safe water, and other critical services remains elusive" (World Bank, 2019) resulted by obstructed supply in infrastructure followed by infrastructure gaps. The difference between the available amount of infrastructure and the required amount of infrastructure in each sector is defined as infrastructure gap. The required amount often set to be 100%. The reason for the infrastructure gaps is an inadequate supply of infrastructure due to budgetary constraints. Developing countries face tight budgets and must transfer public expenditure for the most required sectors. Tight budgets cannot afford huge infrastructure investment, and therefore the infrastructure often neglected to leave infrastructure gaps. "Infrastructure needs and financing is more severe in developing countries," as finds in (Akitoby, 2007).

Figure 1 and 2 explain the poverty trends in sample countries from 2005 to 2015 at USD 1.90 per day and USD 3.20 per day, respectively. The highest poverty rates represent in India, followed by Bangladesh, while in Malaysia and Thailand represents the lowest. The poverty headcount ratio per day is declining but remains high in 21.3% (USD 1.90) and 81.10% (USD 3.20) in India. Population living under USD 3.20 per day is more significant than that of the population living in USD 1.90 per day.

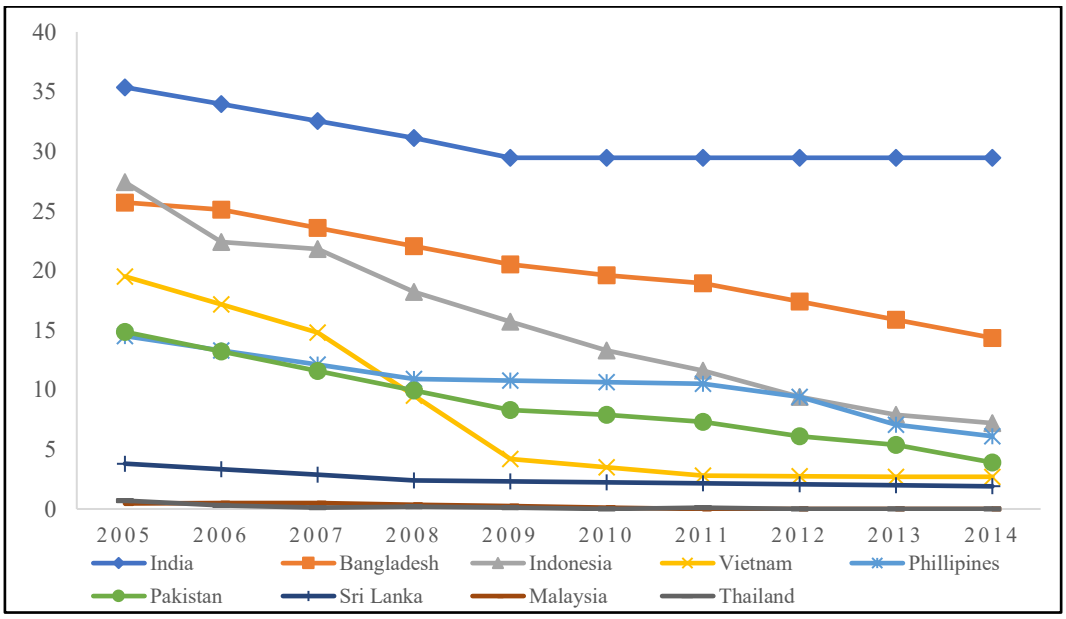


Figure 1 Percentage of people living under USD 1.90 per day in Sample Countries
Note: Extreme poverty level at USD1.90 is reducing during sample period.
Source: Author based on data from PovcalNet

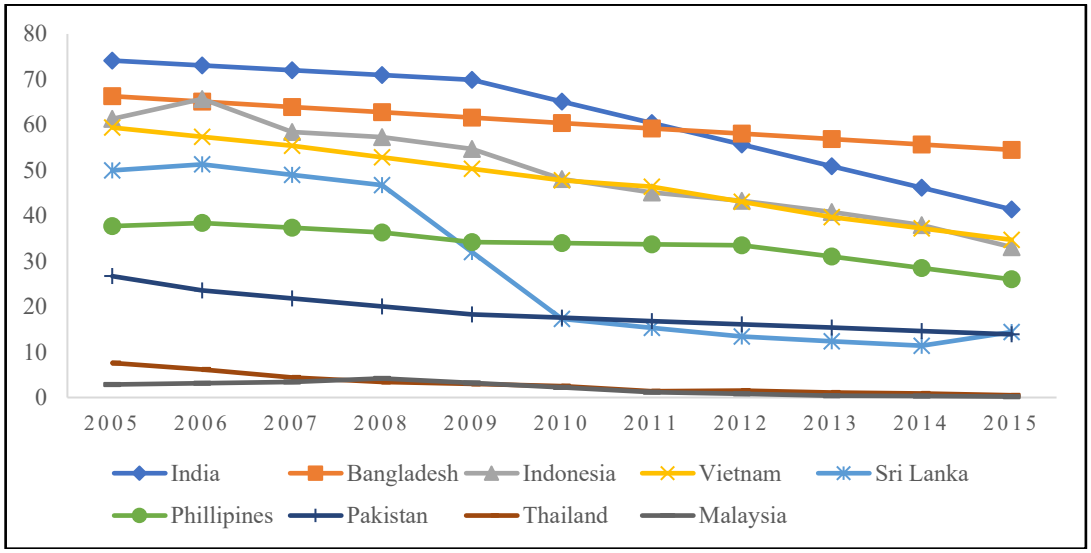


Figure 2 Percentage of people living under USD 3.20 per day in Sample Countries
Note: Extreme poverty level at USD3.20 is still remains at a high-level during sample period.
Source: Author based on data PovcalNet

This study aims to estimate the effect of access to infrastructure to reduce poverty in developing countries in Asia by using panel data from 1990-2015 in the sample of nine developing countries[4] according to availability of data. Lower access and poor quality of infrastructure leads to poverty. The sample countries are Bangladesh, India, Indonesia, Malaysia, Pakistan, Philippines, Sri Lanka, and Thailand (Appendix 1).

Previous research on infrastructure and poverty are mainly based either on qualitative approach or case studies and mainly country specific studies. The selection criteria of the type of poverty reduction infrastructure is doubtful. The research gap is the lack of quantitative studies in terms of access to infrastructure and poverty reduction in existing literature and no studies have estimated long run effects of access to infrastructure. This paper contributes addressing this gap in the literature, estimating the effect of access to infrastructure to reduce poverty developing countries in Asia in the short run and long run. A variable is created by combining access to electricity, water and sanitation to capture the importance of infrastructure to reduce poverty according to the income groups. At this point, this paper contributes to quantitatively modern discussion of infrastructure and poverty at the regional level. The second contribution is in terms of filling the gap in the literature. Poverty reduction through the estimation of access to infrastructure has hardly been researched area yet very important in terms of developing countries. Developing countries face investment bottlenecks and policy makers have to prioritize scarce investment between physical capital and human capital. Results of this study contributes policy makers to prioritize physical investment in developing countries.

Table 1 describes the percentage of people with access to electricity, water, and sanitation from the year 2000 to 2015 and the population living under the poverty line of USD1.90 per day. Malaysia records 100% of access to electricity,98.2% of access to water, and 96% of sanitation and eradicated poverty at USD1.90 in the period concerned proceeded by Thailand. Both countries shifted to the next level of economic growth and labeled as upper-middle-income countries.
.

[4] World Bank classification (2017)

Table 1: Nexus between Access to Infrastructure and Poverty Reduction (2000 -2015)

Country	Access to Infrastructure as a Percentage of People						Poverty Head Count Ratio USD1.90 per Day	
	Electricity		Water		Sanitation			
	2000	2015	2000	2015	2000	2015	2000	2015
Bangladesh	32.0	68.2	76.0	86.9	45.4	60.6	34.8	12.7
India	59.4	88.0	80.6	94.1	25.6	39.6	40.6	29.5
Indonesia	86.3	97.5	77.9	87.4	47.1	60.8	39.3	7.2
Malaysia	97.0	100.0	94.1	98.2	91.2	96.0	0.4	0.0
Pakistan	75.3	93.5	88.5	91.4	36.9	63.5	26.0	3.9
Philippines	73.5	89.1	87.1	91.8	63.8	73.9	13.9	6.1
Sri Lanka	69.6	93.9	79.7	95.6	81.2	95.1	12.4	1.9
Thailand	82.1	99.6	91.9	97.8	91.3	93.0	2.5	0.0
Vietnam	86.2	100.0	77.4	97.6	52.9	78.0	36.7	2.7

Note: Access to electricity, water and sanitation has improved from year 2000-2015 lowering poverty head count ratio

Source: Author database on WHO/UNICEF Joint Monitoring Program (JMP) for Water Supply and Sanitation. Private Participation in Infrastructure Database, World Bank (2017), Sustainable Energy for All (SE4ALL) database, PovcalNet

The lowest access to electricity and water is recorded by Bangladesh while India records the lowest access to sanitation, housing the highest percentage of poor people living in poverty under USD 1.90 in 2015. Countries with a higher percentage of access to infrastructure records the lowest poverty and lower access to infrastructure records higher poverty percentage denoting access to infrastructure is a reason to reduce poverty in developing countries.

Infrastructure poverty linkage is explained in various aspects as poverty itself alone is a multidimensional concept, while infrastructure has both socio-economic impacts of poverty. Infrastructure development is recognized as the key element of poverty alleviation as infrastructure serves as multifaceted miens. This paper structures as introduction, literature review; data and methodology, discussion of results, and conclusion of the study.

LITERATURE REVIEW

Theoretical Approach: Theory of Development and Poverty

Infrastructure has growth effect through different channels and increase in public investment leads to economic growth followed by poverty reduction. Huge investment in infrastructure leads to economic growth specially in developing countries according to the "Big Push", by (Rosenstein-Rodan,1943). Infrastructure services of electricity, sanitation and water has a strong health and education impact leading improvement of human capital. Theory of development considers infrastructure is essential for the growth (Agenor,2006) where infrastructure, health and savings are interconnected and these three factors jointly decide the growth rate. Health services of the economy are decided by the infrastructure, and better health services promote healthy work force followed by increased productivity and large output. Better health reduces medical expenses and increase savings. According to the theory of development, infrastructure reduces poverty enhancing the quality of human capital and saving medical expenses. Public investment reduces poverty according to empirical studies. Since poverty is multidimensional, it is technical to look at poverty in terms of public investment as the effects are multifaceted. Both public investment and private investments are important as public investment mainly focuses on (Construction on roads, power plants, ports, etc.), and private investment focuses on private goods such as

buildings. It is impossible to focus on poverty reduction leaving behind economic growth. The ultimate effect of economic growth trickles down to reduce poverty as the overall impact has direct and indirect effects on poverty. Economic growth generates by the amount of public investment and existing stock of public investment. Keynesian economists suggest public investment boost aggregate demand, which will trickle down to reduce poverty. Public investment leads to crowd in effects where public and private investment is complementary to each other. According to Barro, the crowd in effect takes place according to the level of growth in the economy, whereas at the beginning, positive returns to scale on private investment what we call as "crowd in effect" and later converts to diminishing returns to scale (Barro, 1990) .

Existing literature proves poverty reduction effects of infrastructure, provision of quality infrastructure and make them accessible, and policy gaps in infrastructure in terms of developing countries. These studies incorporate with one particular kind of infrastructure or combination according to the availability of data. Research gap includes lack of estimation of causality and no studies yet considered the type of poverty reduction infrastructure particularly followed by quantitative analysis. Country specific studies find public investment reduces poverty (Sasmal & Sasmal,2016) and investment in infrastructure reduces poverty (Chotia & Rao,2017b) in Indian context. Both of these studies focus on investment and poverty. Access to infrastructure connects to reduce poverty more than the investment (Timilsina, Hochman, & Song, 2020).The effects of infrastructure and poverty reduction have long run effects and estimation of long run effects of infrastructure hardly seen in the literature.

Nexus between Infrastructure and Poverty Reduction

South Asia is a region with complex characteristics of both chronicle and transient poverty. Infrastructure helps to reduce many channels having trickledown effect on the grass-root level, reducing not only the poverty incident but also chronicle poverty (Calderón, 2014) .The linkage between infrastructure and poverty is not directly addressed in literature and a few studies investigate the relationship using either qualitative approach or case studies (Timilsina, Hochman, & Song, 2020).

Poverty is a multidimensional concept and commonly viewed in infrastructure literature as inaccessibility of basic human needs of health, education, drinking water, sanitation, and electricity services by the poor which is closely associated with poverty in developing countries. "Lack of access to basic services is closely linked to poverty," and *access* to clean water and sanitation of the people in rural areas, and especially people in low-income countries fall into the category of poverty (Andres, 2013). Disparity in access to electricity is widely pronounced in the rural-urban sense in most of the low-income countries. Poverty is an outcome of policy gaps in infrastructure policies (Dappe, 2015) and addresses this gap between policy planning and the actual requirement of "infrastructure, especially in the South Asian region." Poor people in developing countries demand infrastructure facilities either due to the inability to access core infrastructure or cannot afford the available infrastructure (Antonio, 2012).Estache sums up the direct and indirect effects of improving infrastructure and poverty reduction (Estache, 2010). More investment in infrastructure provides more opportunities to access infrastructure to the poor - especially in terms of education, health, and income generation. Developing infrastructure is combatting persisting poverty in developing countries according to (Kirkpatrick, 2008). The finding keeps consistent with (Calderón and Servén, 2008) as cited in his paper, "Infrastructure development is a win-win ingredient of poverty reduction." Poverty is an outcome of a lack of proper quantity of infrastructure combined with the inaccessibility of infrastructure (Pouliquen, 2000) . Brenneman and Pouliquen specifically conclude poverty reduction infrastructure as found in works of (Brenneman, 2002) (Pouliquen, 2000). Brenneman considers the improvement of electricity, energy, education, health, and transport helps to alleviate poverty (Brenneman, 2002).

Education is one of the significant determinants of reducing poverty according to (World Bank, 2018) and reflects that educated households usually engage with high income-generating jobs allowing them to reach out of poverty. Global poverty can be lessened by 55% if the adults' population has fulfilled primary and secondary education (UNESCO, 2017). Importance of primary and secondary education, reducing global poverty documents in (UN, 2019). Personal remittance has an impact on reducing poverty, and remittance increases consumption as poor people first try to fulfill their basic needs. Studies regarding personal remittance and poverty conclude poverty reduction effect of remittances received and decrease inequality (Pekovic, 2017) (Acharya & Leon-Gonzalez, 2012) (World Bank,2006). Population growth rate and poverty has a strong linkage, and this link has been explained by different approaches by different schools of thought, as availability of human capital depends on population growth (Makkik, Ghani, and Sultan, 2005). Poverty influences population dynamics, according to (UNFPA, 2014). Population growth rate and poverty have a positive relationship in developing countries as a small amount of wealth is shared among many people, denoting large level of income inequality. Gini coefficient explains the inequality of a country ranging from zero to one (0 – 1); graphically, this is the area between the Lorenz curve and the equality line. This gap is wider in sample countries representing the high level of inequality. Inequality and poverty have a positive relationship representing poor people receive a lower share of GDP or national wealth, and a higher share of GDP is shared among a few rich people. Unemployment and poverty have a positive significance. Unemployment makes poor people vulnerable to risk making poorer. The findings of the link between unemployment and poverty are inconclusive as poverty in the developing countries and the developed countries do not share the same characteristics (Saunders, 2002) (Visaria, 1981). Figure 3 is the conceptual framework of the study. Economic and social infrastructure differentiated according to (Fourie, 2006).

Access to Infrastructure and Poverty Nexus (2000-2015)

Figures 4 and 5 explain inaccessibility to each infrastructure and poverty linkage at USD 1.90 and USD 3.20 per day from the year 2000 to 2015- poverty is described as a reason for lack of access to electricity, water, and sanitation. Accessibility to each infrastructure has been increased and extreme poverty has reduced in sample countries. This idea disclosed in the figures by reducing the area of poverty. People living without access to electricity and sanitation were high in Bangladesh in the year 2000 and therefore poverty in both USD 1.90 per day and 3.20 per day was high. In the year 2015, Bangladesh inaccessibility to electricity and water was reduced; therefore, poverty at both poverty lines reduced. The poverty rate is still high, as inaccessibility of sanitation is remaining as a challenge to Bangladesh. India has the challenge of inaccessibility to sanitation that makes the poverty range larger and inaccessibility to electricity has been reduced, leaving a huge level of the gap in sanitation yet. According to the figure, a lack of sanitation is a challenge to reduce extreme poverty in India.

The area of poverty was large in both Indonesia and Pakistan in the year 2000 and reduced by 2015, improving access to electricity and water. In Indonesia, reducing inaccessibility in electricity and water leads to reduce poverty. Lack of access to sanitation is remaining as a challenge leaving the scope of poverty large in Malaysia. Poverty in Pakistan has reduced as a result of improving access to electricity and sanitation. The area denoting poverty has shrunk in the Philippines by the year 2015, denoting reduced inaccessibility to electricity, water, and sanitation. Sri Lanka has reduced poverty largely in the period concerned by improving access to electricity, water, and sanitation. Vietnam and Malaysia improved access to electricity, water, and sanitation, and poverty in the period concerned is reduced dramatically. Lack of sanitation is a challenge to both countries, leaving poverty scope large. Sri Lanka, Vietnam, Malaysia, and Thailand disclose smaller poverty areas in comparison to other sample countries by reducing inaccessibility to infrastructure during the period of 2000 – 2015. Thailand has reduced inaccessibility to electricity and water,

leading to poverty reduction at both poverty lines.

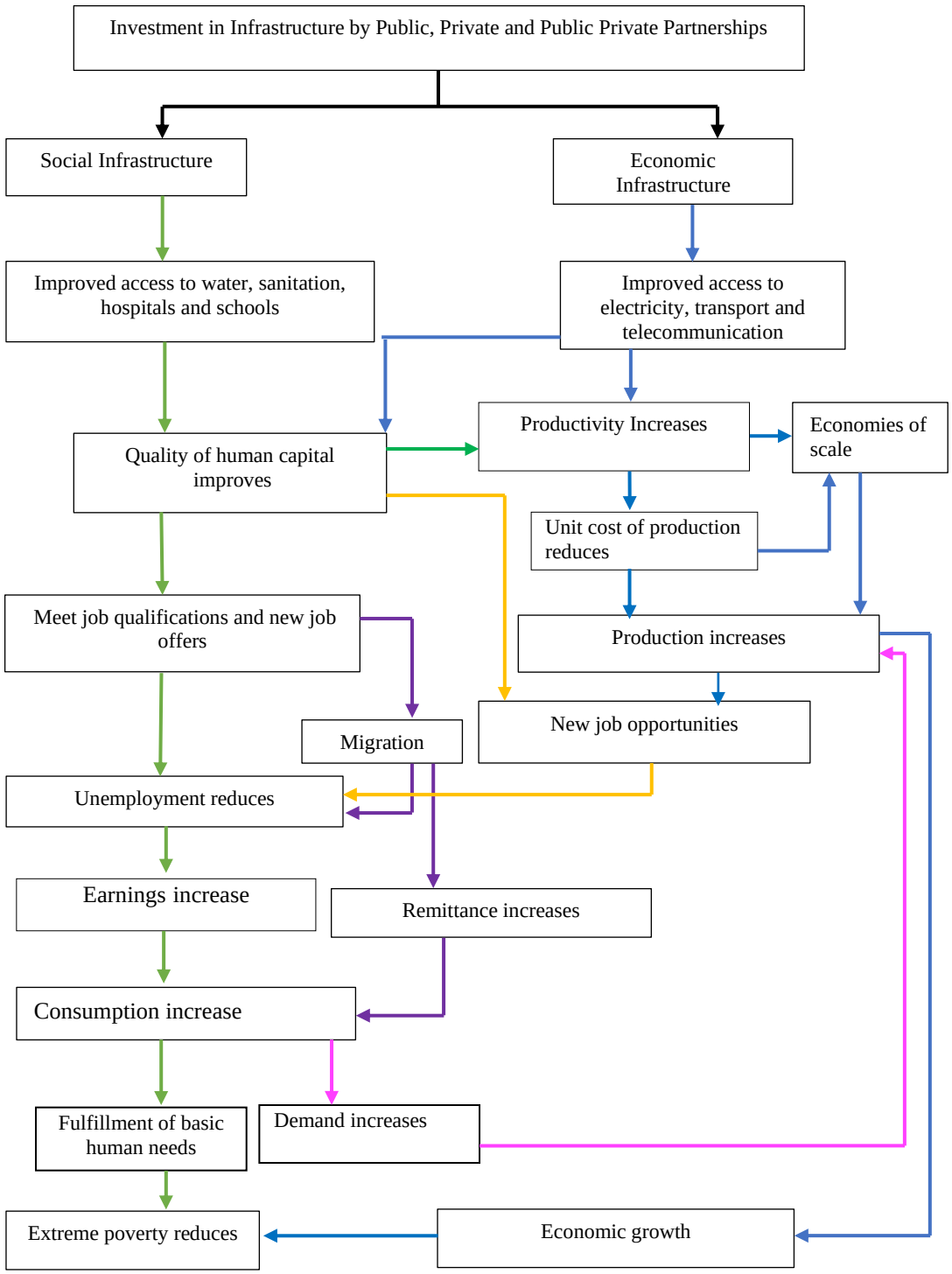
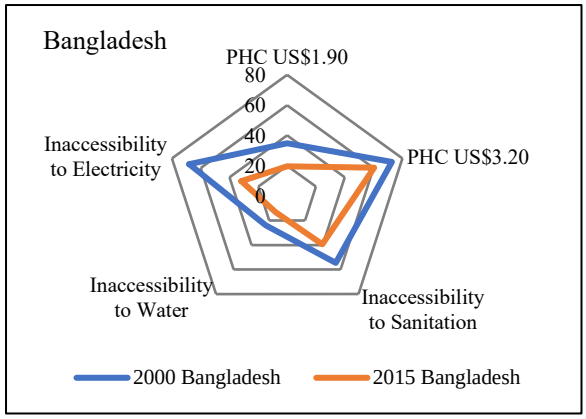
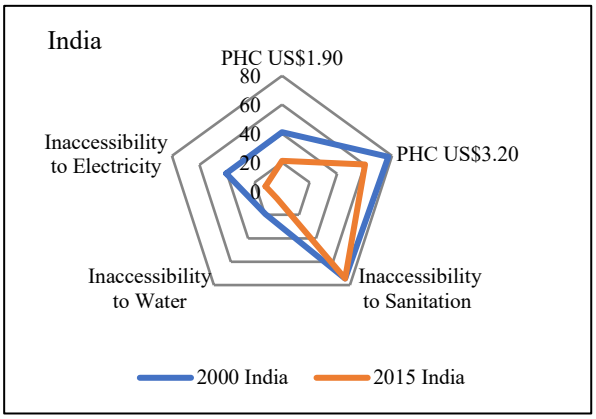
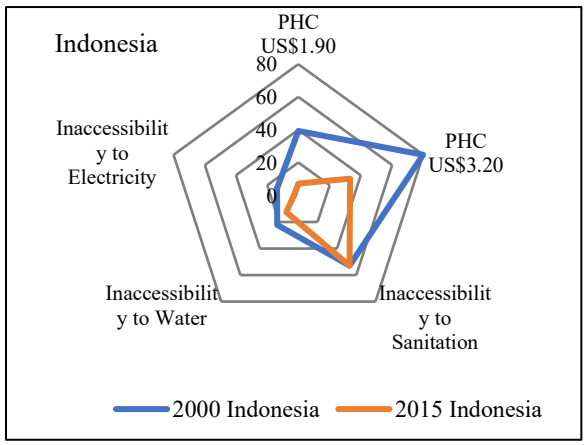


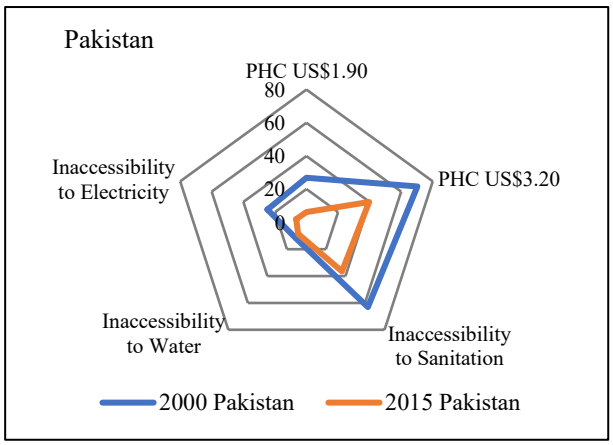
Figure 3 Conceptual Framework of Infrastructure and Poverty Reduction

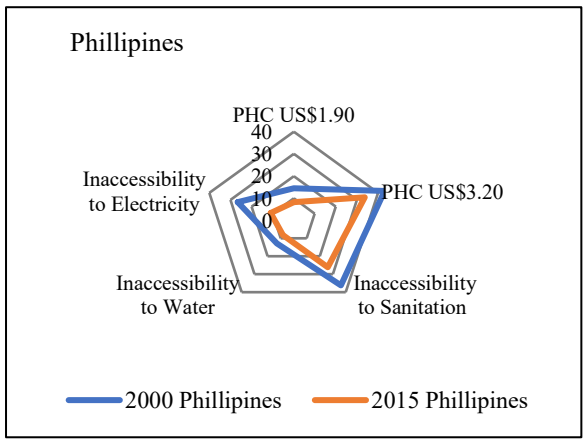
Note: The importance of infrastructure to reduce poverty

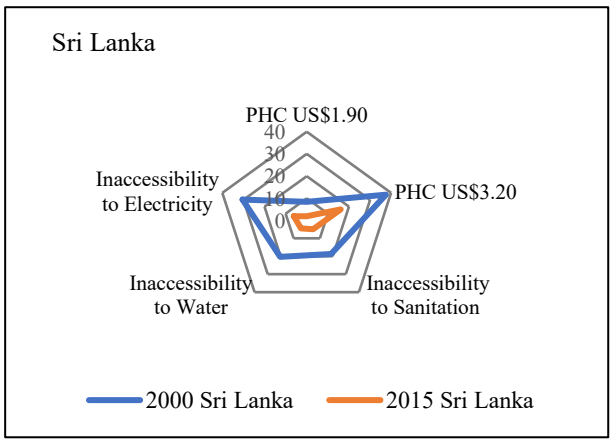

Bangladesh
PHC US$1.90
80
60
40
20
0
PHC US$3.20
Inaccessibility to Sanitation
Inaccessibility to Water
Inaccessibility to Electricity
2000 Bangladesh
2015 Bangladesh


India
PHC US$1.90
80
60
40
20
0
PHC US$3.20
Inaccessibility to Sanitation
Inaccessibility to Water
Inaccessibility to Electricity
2000 India
2015 India


Indonesia
PHC US$1.90
80
60
40
20
0
PHC US$3.20
Inaccessibility to Sanitation
Inaccessibility to Water
Inaccessibility to Electricity
2000 Indonesia
2015 Indonesia


Pakistan
PHC US$1.90
80
60
40
20
0
PHC US$3.20
Inaccessibility to Sanitation
Inaccessibility to Water
Inaccessibility to Electricity
2000 Pakistan
2015 Pakistan


Phillipines
PHC US$1.90
40
30
20
10
0
PHC US$3.20
Inaccessibility to Sanitation
Inaccessibility to Water
Inaccessibility to Electricity
2000 Phillipines
2015 Phillipines


Sri Lanka
PHC US$1.90
40
30
20
10
0
PHC US$3.20
Inaccessibility to Sanitation
Inaccessibility to Water
Inaccessibility to Electricity
2000 Sri Lanka
2015 Sri Lanka

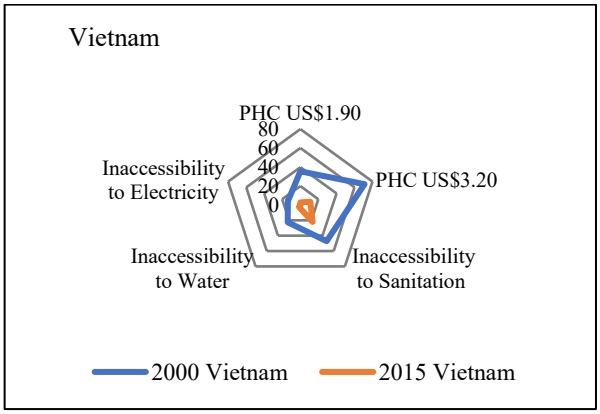
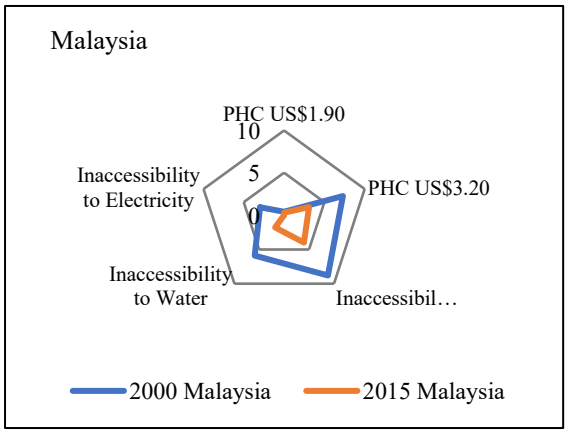


Figure 4 Infrastructure and Poverty in Lower Middle-Income Countries
Note: Access to electricity and water has improved leading reduction in extreme poverty. Access to sanitation is still a challenge in lower middle-income countries.
PHC US$1.90 = Poverty headcount ratio at US$1.90 perday,2011 Purchasing power Parity (% of population);
PHC US$3.20 = Poverty headcount ratio at US$1.90 perday,2011 Purchasing power Parity (% of population)
Source: Author based on WHO/UNICEF Joint Monitoring Programme (JMP) for Water supply and Sanitation World Bank, Sustainable Energy for All (SE4ALL) Database



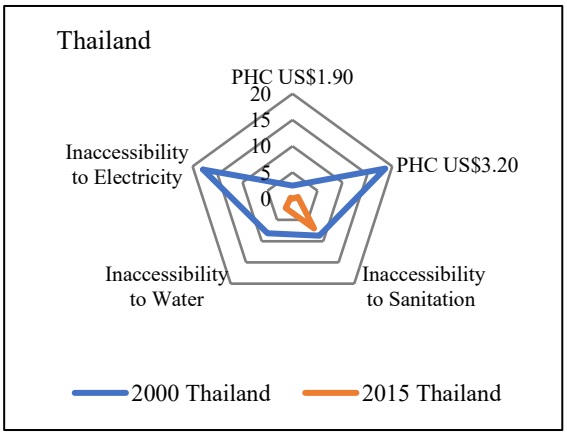


Figure 5 Infrastructure and Poverty in Upper Middle-Income Countries

Note: Access to infrastructure has improved leading reduction in extreme poverty in upper middle-income countries.
PHC US$1.90 = Poverty headcount ratio at US$1.90 perday,2011 Purchasing power Parity (% of population);
PHC US$3.20 = Poverty headcount ratio at US$1.90 perday,2011 Purchasing power Parity (% of population)
Source: Author based on WHO/UNICEF Joint Monitoring Programme (JMP) for Water supply and Sanitation, World Bank, Sustainable Energy for All (SE4ALL) Database

Poverty in Thailand was high in the year 2000 and reduced largely by 2015, denoting reduced inaccessibility in electricity and water. Lack of access to water still remains as a challenge. Inaccessibility to infrastructure and poverty has a positive relationship showing lower level of access to electricity, water, and sanitation is a reason to poverty. Multidimensional Poverty Index captures the importance of access to these three sectors.

Multidimensional Poverty Index (MPI)

Poverty is multidimensional, and multidimensionality of poverty is captured by Multidimensional Poverty Index (MPI) recently by Oxford Poverty and Human Development Initiative (2018) equally prioritizing the areas of education, health, and living standard weighing 1/3 each (UNDP, 2019), disclosing lack of education, lack of health and lack of good living standard are reasons to poverty. The living standard is subcategorized under six topics and three sub-topics related to infrastructure, namely electricity, sanitation, and water. MPI is to capture the multidimensionality of poverty and considered as an internationally comparable index. The index based on ten indicators, out of which three indicators represent infrastructure. The index ranges from one to zero, where higher values denote a larger scale of poverty vice versa.

To combat poverty, the good living standard should be ensured, which is measured by weighing non-monetary units of "cooking fuel, sanitation, drinking water, electricity, housing, and assets". Provision of Sanitation, drinking water, and electricity are considered as parts of infrastructure. Health and education have an indirect relationship in terms of supplying buildings and access roads. The methodology of the paper develops upon access to infrastructure variable, which is a combination of access to sanitation, access to clean water, and access to electricity being shed light components of MPI as they are recognized as effects of poverty (Bandre,2015) (Andres, Biller & Dappe, 2013) (Zaure,2007) and can be categorized as components of infrastructure.

METHODOLOGY AND DATA

Access to Infrastructure variable and Principal Component Analysis

Access to infrastructure variable is created by using the data of access to electricity, access to water and access to sanitation by using principal component analysis (PCA), which can be introduced as a "dimension reduction tool," and "an analysis of identification of the pattern of data". It largely uses to condense a large set of variables into a small number of variables keeping proportional weight of the variables (Jolliffe and Cadima,2016). The PCA is based on independency of the variables considering the variance of the components which is the deviation from the mean point leaving vectors to minimize interdependency. Covariance measures the amount of each vector varies from the mean value with respect to other vectors. This analysis creates a new de-correlated set of data without changing the direction and maximizing the covariance. The direction of the analysis is confirmed by eigenvectors under linear transformation. The change of the dimension is denoted by eigenvalues. Therefore, PCA minimizes correlation when transforming variables into a new variable while weighing each component accordingly. High correlation leads to flaws in methodology and spurious estimated results which is misleading. The correlation is high in this study and therefore PCA is used following previous literature to control the issue of high correlation (Calderon & Serven,2010). Correlation between (i) GDP per capita income and access to sanitation (0.75), (ii) access to water and electricity (0.73), and (iii) GDP per capita and access to water (0.72) are high as finds in table 2. The second reason is (b) Upward trend of access to water, access to sanitation, and access to electricity in sample countries, and they can be condensed into one variable.

Poverty data, personal remittance, population growth rate, literacy rate of age 15 and above, Gini and unemployment data are obtained from World Bank Development Research Group data while access to water and sanitation data is from WHO/UNICEF Joint

Monitoring Programme (JMP) for Water Supply and Sanitation data set. Access to electricity data is from the World Bank, Sustainable Energy for All (SE4ALL) database. Access to electricity, Access to Water and sanitation, unemployment, personal remittance, population growth rates, literacy rate, and poverty data are in percentage. (Appendix 2). This analysis meets missing data. Missing data is treated by using the interpolation technique when the data is missing between known values.

The methodology of the paper is developed on (Marinho, 2017),where poverty is a function of infrastructure and analyzed for the states of Brazil for 2000-2009. Marinho (2017) is a country-specific study and the equation designed to capture country-specific features. Country characteristics are different, and tailor-made model specification cannot capture the features in each country since this study is a country specific study. The population growth rate is another reason to persisting a high level of poverty in developing countries as small amount of wealth is shared among large population due to high income inequality (Makkik,Ghani,and Sultan, 2005). Therefore, the population growth rate is added to the original equation. Government budget revenue data is not available in some countries. Therefore, government budget revenue is not considered in the study. Average years of schooling are replaced with literacy rate as the years of schooling reflect the length of the period of study. The period unable to capture the literacy rate of the population.

Low level of access to infrastructure is another reason for poverty, as finds in literature. The infrastructure variable in the original equation revised introducing access to infrastructure variable by the percentage of people. At this point, the infrastructure selected to calculate the multidimensional poverty index (MPI) was used as they are recognized as infrastructure reasoning, mostly to poverty. Therefore, access to electricity, access to sanitation, and access to water by 100 people were used to create access to infrastructure variable. Personal remittance is introduced to the equation as the majority of poor people in developing countries work low skilled jobs in developed countries, and as a result, the share of personal remittance in GDP is increasing. The other reason is personal remittances in developing countries mainly used to consumption (Christian and Jean-Louis, 2010) (Karine, 2014). Therefore, equation (1) can be written as follows introducing access to electricity (*ae*), access to improved sanitation (*as*), access to clean water (*aw*), personal remittance (*rem*), and population growth rate (*pgr*).

$$p_{it} = \beta_0 + \beta_1 p_{it-1} + \beta_2 inf_{it} + \beta_3 pib_{it} + \beta_4 aem_{it} + \beta_5 gini_{it} + \beta_6 regov_{it} + \beta_7\, des_{it} \text{-------- (1)}$$

Whereas,

p_{it} = poverty index
p_{it-1} = Poverty index of the previous year
inf_{it} = Infrastructure Index
pib_{it} = GDP per capita
aem_{it} = Average years of schooling for the people of 25 years old
$gini_{it}$ = Gini index
$regov_{it}$ = Government budget revenue
des_{it} = Unemployment rate of the country "*i*" th state of Brazil and "*t*" th time.

$$p_{it} = \beta_0 + \beta_1 ae_{it} + \beta_2 as_{it} + \beta_3 aw_{it} + \beta_4\, p_{it-1} + \beta_5 gdpc_{it} + \beta_6 rem_{it} + \beta_7 pgr_{it} + \beta_8 lit_{it} + \beta_9 unem_{it} + \beta_{10} gini_{it} \text{ ---------- (2)}$$

Equation 3 is the equation with the access to infrastructure variable *(infin)* combining access to electricity (*ae*), access to improved sanitation (*as*), access to clean water (*aw*),

$$p_{it} = \beta_0 + \beta_1\, infin_{it} + \beta_2 p_{it-1} + \beta_3\, gdpc_{it} + \beta_4\, rem_{it} + \beta_5\, pgr_{it} + \beta_6\, lit_{it} + \beta_7\, unem_{it} + \beta_8\, gini_{it} \text{----------(3)}$$

Poverty reduction effect of infrastructure is a long-run process, and this paper estimated the long-run effect of each variable using the lag effect of the dependent variable. In equation (4), "*b*" is the short-run effect of the "x" variable at a time "*t.*"

$$Y_t = a + bx_t + cy_{t-1} \text{ ----------(4)}$$

The long-run equation can be written as,

$Y_t = Y_{t-1}$ where Y_∞ . The long-run effect can be derived, following the below steps.

$$Y = a + bx + cy$$

$$(1-c)y = a + bx$$

$Y = \frac{a}{1-c} + \frac{b}{1-c}x$ where long run effect will be $\frac{b}{1-c}$. Following $\frac{b}{1-c}$ long-run effect of each variable on poverty is estimated

.

The percentage of population in extreme poverty is determined by access to infrastructure, personal remittance, population growth rate, literacy rate, unemployment, and income disparity. This paper estimates equation (3) using the fixed effect model. At this point, this paper divides the group of countries into two depending on the income level following (World Bank, 2017) as Lower Middle-income developing countries (LMI) and Upper Middle-Income developing countries (UMI). Dependent variable is poverty headcount ratio at USD 1.90 per day and USD 3.20 per day. Then, this paper estimated the individual impact of access to infrastructure in country groups and finds each of the infrastructure variables contributes to reducing poverty (Appendix 3), having significant results of poverty reduction effect of access to infrastructure individually, the paper composed access to infrastructure variables. The theoretical literature on determinants of poverty provides an inconsistency in the findings. Therefore, this paper tested the causality to observe the direction of the relationship between access to infrastructure and poverty reduction (Appendix 5). At this point, the unidirectional causality is investigated, running from access to infrastructure to both lines of poverty representing lower access to electricity, sanitation, and water is a reason to extreme poverty in sample countries and poverty is not a reason for lack of infrastructure. Since the causality is unidirectional, running from infrastructure to poverty, the paper estimates the effect of access to infrastructure to poverty. Equation 3 is estimated under three models.

Ordinary least square method is used at this stage to control unknown parameters, and the model is to be unbiased. This paper occupies panel data and both fixed effects (FE) and random effects (RE) models are estimated. Fixed effects models control country-specific effects and time-specific effects, and therefore, results are not correlated. Therefore, the results generated by the model are not biased. The RE model uncorrelated with the independent variable and assumes time-specific and country-specific variations are random. The Hauseman test[5] results used to define the better model. In the sample of UMI, the sample size is small, and the number of years is large. The fixed effect model is recommended by Gujarati (Gujarati and Dawn, 2011:291) when the sample size is smaller than the number of years. The maximum lags are used in the model is one. Table 2 explains correlation matrix and the correlation between PHC1.90 and PHC3.20 is 0.93, which are dependent variables in this study as poverty is analyzed under two poverty lines.

[5] Hauseman test helps to select a better model between fixed effects and random effects, having the null hypothesis of preference to the random effect model. An alternative hypothesis is the preference of the fixed effect model. Hauseman test detects the correlation between the errors and the regressors.

Table 2 Correlation Matrix with Original Data

variable	*phc190*	*phc320*	*ae*	*as*	*aw*	*gdpc*	*gini*	*lit*	*pgr*	*prem*	*unem*
phc190	1										
phc320	0.9398	1									
ae	-0.6743	-0.6693	1								
as	-0.8926	-0.9474	0.5825	1							
aw	-0.7918	-0.8256	0.7337	0.6620	1						
gdpc	-0.6804	-0.8039	0.5924	0.7578	0.7230	1					
gini	-0.4568	-0.5586	0.3366	0.5568	0.3757	0.4960	1				
lit	-0.5111	-0.6164	0.6659	0.6690	0.3730	0.4591	0.6387	1			
pgr	0.2718	0.3634	-0.2232	-0.4786	-0.0988	-0.1653	0.0296	-0.5612	1		
prem	0.0847	0.1886	-0.3091	-0.1243	-0.2653	-0.5553	0.2179	0.0137	0.0393	1	
unem	0.0509	0.0835	-0.1958	0.0831	-0.4353	-0.0116	0.2786	0.2255	-0.1725	0.2056	1

Note: Variables are explained in Appendix 2
Source: Author

Table 3 Composition of access to Infrastructure Variable

Eigenvalues:(sum =3, Average =1)					
Variable	Value	Difference	Proportion	Cumulative value	Cumulative Proportion
Access to electricity	2.2722	1.8362	0.7574	2.2722	0.7574
Access to sanitation	0.4359	0.1441	0.1453	2.7081	0.9027
Access to water	0.2918		0.0973	3	1

Note: Proportion of electricity weights most followed by sanitation and water
Source: Author

Table 3 explains the proportional composition of access to infrastructure variable. Eigen values explain the variance of each component of the infrastructure variable that composites access to electricity, sanitation and water. Since this study occupies three variables the total value of Eigenvalues is 3 and average is 1. The system generates relative importance of each component where the first component carries largest variance. The factor loading of electricity amounts to 0.76, water 0.15, and sanitation is 0.09 denoting electricity amounts more than 75% of the variable and water 15% and sanitation 9%. Correlation within the access to infrastructure variable is comparatively low after introducing access to infrastructure variable composed by using PCA. The highest correlation is between water and electricity, which is 0.70 (Appendix 4). These values are for access to infrastructure variables for all countries in the sample. Access to infrastructure variable is created separately for each model by using the same method. Data for each factor is the percentage of the population with access to each infrastructure. The paper estimates three models using each of access infrastructure factor and found significance in reducing poverty at USD 1.90 and USD 3.20 (Appendix 3). Table 4 sums up descriptive statistics of the model variables, and the total number of observations is 234. The highest mean and medium value are represented by *gdpc*, and the lowest is *pgr*.

Table 4 Descriptive Statistics of Infrastructure and Poverty

Variable	*ae*	*as*	*aw*	*gdpc*	*gini*	*lit*	*pgr*	*phc190*	*phc320*	*prem*	*unem*
Mean	77.54	63.44	86.13	7047.89	36.92	1.87	1.54	17.59	43.64	3.91	3.52
Median	83.52	63.25	87.90	5080.46	35.55	1.96	1.50	13.19	42.30	3.05	3.07
Maximum	100.00	96.00	98.20	25390.44	49.10	1.98	2.87	66.70	90.20	13.32	14.66
Minimum	13.45	19.80	68.90	1340.26	27.60	1.56	0.13	0.00	0.20	0.11	0.40
Std. Dev.	20.63	23.27	7.67	5349.80	5.57	0.13	0.64	16.37	27.62	3.38	2.71
Skewness	-1.18	-0.11	-0.45	1.46	0.79	-0.94	0.13	0.77	-0.13	0.84	1.80
Kurtosis	3.93	1.71	2.23	4.49	2.46	2.22	2.20	2.62	1.64	2.76	6.94
Jarque-Bera	49.97	13.18	10.83	83.38	21.50	31.86	5.55	19.58	14.82	22.37	220.61

Note: The highest mean value is represented by *gdpc* followed by access to water.
Source: Author

Table 5 Unit Root Test of the Variables of Access to Infrastructure and Poverty Reduction

Test	LLC		IPS		ADF	
	Level	FD	Level	FD	Level	FD
Gdpc	7.9483	-10.0434	10.2146	-10.6482	0.3196	127.939
probability	*1.0000*	*0.0000*	*1.0000*	*0.0000*	*1.0000*	*0.0000*
Gini	-0.8351	-4.9094	-1.2996	-4.6097	36.0743	55.9928
probability	*0.2018*	*0.0000*	*0.0969*	*0.0000*	*0.0069*	*0.0000*
Infin	-3.2318	-1.5554	0.3255	-8.1430	19.236	112.203
probability	*0.0006*	*0.0499*	*0.6276*	*0.0000*	*35.218*	*0.0000*
lit	-8.0737		-2.5450		49.3745	
probability	*0.0000*		*0.0055*		*0.0001*	
pgr	-4.0309	-14.4557	-0.3653	-16.2537	32.0811	200.455
probability	*0.0000*	*0.0000*	*0.3575*	*0.0000*	*0.0215*	*0.0000*
phc190	-1.5890	-4.3425	0.7711	-4.1908	17.5146	51.3587
probability	*0.0560*	*0.0000*	*0.7797*	*0.0000*	*0.4880*	*0.0000*
phc320	0.6038	-1.3259	4.2172	-1.7418	5.9950	36.9258
probability	*0.7270*	*0.0424*	*1.0000*	*0.0408*	*0.9962*	*0.0054*
prem	-1.8431	-5.0665	-0.4138	-6.3756	16.8276	74.1400
probability	*0.0327*	*0.0000*	*0.3395*	*0.0000*	*0.5350*	*0.0000*
unem	-1.4714	-4.6329	-0.5276	-5.7559	23.811	68.0666
probability	*0.0706*	*0.0000*	*0.2989*	*0.0000*	*0.1613*	*0.0000*

Note: Level – Level Form, FD – First difference, LLC - Levin, Lin & Chu t*, IPS - Im, Pesaran and Shin W-stat, ADF - Fisher Chi-square
Source: Author

Table 5 represents the unit root test of the variables in the analysis. Unit root test is used to detected stationarity of the series using Levin, Lin & Chu (LLC), IM, Pesaran and Shin W- (IPS), and Augmented Dicky- Fuller (ADF) tests. Null hypothesis of the unit root test is the existence of the unit root of the data series. All the variables, except the literacy rate, are stationary at the first difference, meaning the variables are non-stationary at the level form- null hypothesis is accepted at level form as probabilities are greater than 0.05. Literacy rate is stationary at level form denoting no unit root at the level form, and probability is lower than 0.05, meaning a rejection of null hypothesis at level form.

RESULTS DISCUSSION

Table 6 records the results of fixed-effect models. In all countries' sample, access to infrastructure, GDP per capita income, unemployment, literacy rate and population growth rate are significant to reduce poverty. Poverty in the previous year is responsible for the poverty of the current year. The reason for the poverty in Asia is chronical and results keeps consistent with the findings of (Dowling, 2009). Access to infrastructure and poverty has a negative relationship where more access to infrastructure causes to reduce poverty. The expected sign is negative, and results speak a lack of access to infrastructure is a reason for poverty where elasticity of access to infrastructure is -2.74 and -6.40 of poverty at USD 1.90 and 3.20 respectively. This finding is consistent with the idea of (Bandre, 2015) (Zaure, 2007) explaining reasons to poverty as lack of electricity, clean water and sanitation and provisioning them is a strategy for pro poor growth as finds in (OECD, 2007). Population growth rate is another reason for poverty having a positive relationship making conditions worse. Elasticity of population growth to poverty is 1.32 and 0.88 in USD 1.90 and USD 3.20 respectively. Literacy rate and poverty have a negative relationship explaining lack of literacy leads to poverty where 1% increase in literacy rate reduces poverty by 8% and 14% in USD 1.90 and USD 3.20 poverty lines respectively. The relationship between personal remittance and poverty is also negative denoting lack of income is another reason for poverty.

Lower middle-income countries denote the same results as all sample countries with different coefficients. Major reason for poverty is lack of infrastructure showing elasticities of 6 and 2.2 followed by unemployment 0.67 and 0.33 at USD 1.90 and USD 3.20 poverty lines respectively. The results of this study incorporate with higher population growth rate causing poverty. 1% increase in literacy rate can reduce poverty by 32% and 30% at USD 1.90 and USD 3.20 poverty lines respectively. These countries show wider income disparity, and the relationship between income disparity and poverty is positive depends on the transition level. Results of upper-middle-income countries keep consistency with lower-middle-income countries. Lack of access to infrastructure, poverty of the previous year, GDP per capita income, population growth rate are the reasons to poverty. Gini coefficient is not significant in upper middle-income countries which consists of Malaysia and Thailand. Malaysia enjoys reduction in income disparity in inter and intra-ethnic groups (Ravallion, 2019) and Thailand curbs at policy level (World Bank, 2019).

The effect of access to infrastructure to reduce poverty is a long-term process. Therefore, the long-term effect of access to electricity, sanitation, and water on poverty is estimated, and results are presented in Table 7 while the long-term effect of each individual variable in equation (3), following equation (4). The results suggest with respect to infrastructure, long run poverty reduction effect of each variable is lager denoting poverty reduction is a long run process.

Long run poverty reduction effect of infrastructure is larger than the other variables. Theoretically contribution of infrastructure trickles down to poorest group indirectly and consumes times. The results explain large effect of infrastructure reducing poverty of negative 13.8 and negative 30.9 in USD 1.90 and 3.20 poverty lines followed by GDP per capita and population growth. Sample countries report higher poverty level of 29.5(India),12.7(Bangladesh) followed by 7.2(Indonesia) at USD 1.90. Results of the paper speaks the causes of persisting higher poverty level. Population growth rate and poverty have a positive sign showing the developing countries are poor as a result of a higher population growth rate. Unemployment is another positively significant variable, denoting a higher level of unemployment leads to a larger magnitude of poverty incident. Gini coefficient explains both poverty lines are affected by inequality; where larger the inequality, the bigger the poverty effect. Lower GGP per capita, higher population growth rate, larger inequality followed by lack of access to infrastructure explains the nature of poverty in sample countries, and theoretically, the findings support the vicious circle of poverty.

Personal remittance has a negative significant effect reflecting the ability of poverty reduction. Literacy has a negative significance; denoting education has a larger impact on poverty reduction in the long run. These findings suggest countries with a lower level of access to infrastructure suffer more poverty, and the effect of poverty will be larger in the long run.

Table 6 Results of Access to Infrastructure and Poverty Reduction

Model	AC		LMIC		UMIC	
Poverty Line / Variable	PHC190	PHC320	PHC190	PHC320	PHC190	PHC320
Infin	-2.7427***	-6.3931***	-5.9957***	-2.2510**	-2.2853***	-6.5925***
	(-2.95)	(-4.86)	(-3.61)	(-1.93)	(-2.08)	(-3.94)
$Pov_{(it-1)}$	0.8008***	0.7928***	0.3760***	0.7925***	0.6060***	0.3678***
	(14.49)	(15.46)	(6.25)	(7.98)	(6.32)	(2.48)
gdpc	-0.6852**	-0.3402**	-0.1635**	-0.1413**	-0.1369***	-0.3213***
	(-2.12)	(-2.17)	(-2.11)	(-2.07)	(-2.69)	(-2.74)
unem	0.1710**	0.7447*	0.6677**	0.3333**	0.0411	0.3240*
	(1.70)	(1.94)	(2.00)	(1.95)	(0.78)	(2.49)
lit	-0.0870**	-0.1454**	-0.3209***	-0.2964***	-0.0348*	-0.8412*
	(-2.04)	(-2.04)	(-4.75)	(-3.48)	(-1.91)	(-2.45)
gini	0.2808**	0.5845***	0.6133***	0.0651*	0.0121	0.0676
	(2.60)	(3.62)	(3.75)	(1.46)	(0.58)	(0.21)
pgr	1.3250*	0.8820**	0.7592***	0.1322**	0.2723*	0.1814*
	(1.90)	(2.41)	(2.63)	(2.07)	(1.87)	(2.52)
prem	-0.1530	-0.2514	-0.0085	-0.0544	-0.2862	-0.7777*
	(-0.87)	(-0.94)	(-0.02)	(-0.27)	(-0.31)	(-2.52)
R^2	0.97	0.93	0.97	0.98	0.94	0.95
Number of Observations	125	125	89	89	32	32
Number of Cross-sections	9	9	7	7	2	2

Note: AC- All developing countries in the Asia; LMIC- Lower middle-income countries in Asia; UMIC- Upper middle-income countries in Asia; PHC190- Poverty headcount ratio at USD 1.90 per day; PHC320- Poverty headcount ratio at USD 3.20 per day; T values are in parenthesis *** significance level at 1%; ** significance level at 5%; *significance level at 10%

Source: Author

Table 7 Long Term Effect of Infrastructure in Poverty Reduction

Model	Developing Countries in Asia				Lower Middle-Income Countries				Upper Middle-Income Countries			
Poverty Line	PHC190		PHC320		PHC190		PHC320		PHC190		PHC320	
Variable	SR	**LR**	SR	**LR**	SR	**LR**	SR	**LR**	SR	**LR**	SR	**LR**
Infin	-2.74	**-13.77**	-6.39	**-30.85**	-5.99	**-9.61**	-2.25	**-10.85**	-2.28	**-5.80**	-6.59	**-10.43**
gdpc	-0.69	**-3.44**	-0.34	**-1.64**	-0.16	**-0.26**	-0.14	**-0.68**	-0.13	**-0.35**	-0.32	**-0.51**
unem	0.17	**0.86**	0.74	**3.59**	0.66	**1.07**	0.33	**1.61**	0.04	**0.10**	0.32	**0.51**
lit	-0.09	**-0.44**	-0.15	**-0.70**	-0.32	**-0.51**	-0.29	**-1.43**	-0.03	**-0.09**	-0.84	**-1.33**
gini	0.28	**1.41**	0.58	**2.82**	0.61	**0.98**	0.06	**0.31**	0.01	**0.03**	0.06	**0.11**
pgr	1.33	**6.65**	0.88	**4.26**	0.75	**1.22**	0.13	**0.64**	0.27	**0.69**	0.18	**0.29**
prem	-0.15	**-0.77**	-0.25	**-1.21**	-0.08	**-0.14**	-0.05	**-0.26**	-0.28	**-0.73**	-0.77	**-1.23**

Note: PHC190- Poverty headcount ratio at USD 1.90 per day; PHC320- Poverty headcount ratio at USD3.20 per day; SR– Short Run, LR- Long Run
Source: Author

CONCLUSION AND LIMITATIONS

Poverty alleviation is the central theme of the discussion of the decade, and countries follow different strategies to eradicate poverty as it is a critical issue. Infrastructure development is one of the identified sources of reducing poverty in developing countries, it contributes directly through access and indirectly through education and health to reduce poverty improving human capital. Developing countries face investment bottlenecks and policy makers have to decide prioritizing options between physical capital and human capital. Findings of the study guides to prioritize physical capital as human capital can be improved through physical capital and poverty reduction effect is larger in long run.

Investment in infrastructure increases access to better standard infrastructure and better provision of infrastructure enables improving access to clean water, sanitation, electricity, health, and education. Therefore, infrastructure provision is important in reducing poverty, both socially and economically. Access to infrastructure and poverty has a unidirectional causality running from infrastructure to poverty. The link between access to infrastructure and poverty is no longer inconclusive. The reason for poverty in developing countries is not only monetary but also lack of access to infrastructure facilities which is termed as social infrastructure in literature and making living standard lower. Dynamic policies are important in reducing to make poor people capable of breaking the poverty such as making capable of poor people to access to electricity, improved water, sanitation, and education.

The study concludes the importance of access infrastructure reducing poverty occupying data from 1990-2015 samples of 9 developing countries in Asia. Infrastructure poverty linkage is measured under fixed effect and keep consistency with theoretical evidence, and the long-run effect is much larger than that of short-run effect. The finding will be interesting to policymakers as the aim of SDGs is to reduce all forms of poverty by 2030.

Closing down infrastructure gap, making infrastructure accessible and affordable, make

poor beneficiaries of education, attacking persisting income inequality, controlling population growth, reduce unemployment and encourage remittance will encourage to reduce poverty in the sample countries. The limitation of the study is the unavailability of data and previous literature in terms of access to infrastructure and poverty reduction. This study focuses on developing countries in Asia only. In future studies, I suggest to increase the sample size to make a cross comparison of the developing countries in Asia and Africa as the largest proportion of poverty owned by Africa. It is noteworthy to remember investing in one particular type of infrastructure unable to generate large poverty reduction effects when a country undergoes huge infrastructure gaps.

REFERENCES

Acharya, C., & Leon-Gonzalez, R. (2012). The Impact of Remittance on Poverty and Inequality. *GRIPS Discussion Paper No 11-22*.

Agenor,Pieere-Richard (2006).A Theory of Infrastructure-Led Development. Center for Growth and Business Cycle Research, Discussion Paper.

Akitoby, B., Schwartz, G., & Hemming, R. (2007). *Public Investment and Public-Private Partnerships* (No. 40). International Monetary Fund.

Andres, L., Biller, D., & Dappe, M. (2013). *Reducing Poverty by Closing South Asia's Infrastructure Gap.* Washington, DC: The World Bank.

Antonio, E., & Caroline, P. (2012). *The Impact of Private Participation in Infrastructure on Poverty in Developing Countries.* Bruxelles: Universite de Libre de Bruxelles.

Barro, R. J. (1990). Government Spending in a Simple Model of Endogenous Growth. *Journal of Political Economy 98(S5)*, 103-125.

Bandre, B. (2015). *World Economic Forum*. Why Infrastructure Investment is Key to Ending Poverty:https://www.weforum.org/agenda/2015/10/why-infrastructure-investment-is-key-to-ending- poverty/ (last access Oct.15, 2019)

Brenneman, A.,& Kerf, M. (2002). Infrastructure and Poverty Linkages. *A Literature Review.* The World Bank, Washington, DC.

Calderón, C., & Servén, L. (2010). Infrastructure and Economic Development in Sub-Saharan Africa. *Journal of African Economies,19.* (suppl_1), i13-i87.

Calderón., C. (2014). Infrastructure Growth and Inequality an Overview. *World Bank Policy Research Working Paper* No. WPS *7034.*

Chotia, V., & Rao, N.V.M. (2017a). An Empirical Investigation of the link between Infrastructure Development and Poverty Reduction. *International Journal of Social Economics*

Christian, E., & Jean-Louis, C. (2010). Remittances and Household Consumption Instability in Developing Countries. *CERDI Working Paper 201015*.

Dappe, M. (2015). A Methodological Framework for Prioritizing Infrastructure Investment. *World Bank Policy Research Working Paper* No. WPS 7433.

Dowling, J. M., & Yap, C. F. (2009). *Chronic poverty in Asia: Causes, consequences and policies*. World Scientific.

Estache, A. (2010). Infrastructure Finance in Developing Countries: An Overview. *EIB Papers*, *15*(2), 60-88.

Fourie, J. (2006). Economic Infrastructure; A Review of Definitions, Theory and Empirics. *South African Journal of Economics*, 74:530- 556.

Gujarati, D., & Dawn, P. (2011). *Basic Econometrics.* New York: McGra-Hill Irwin.

Hirschman, A. O., & Lindblom, C. E. (1962). Economic Development, Research and Development, Policy Making: Some

Converging Views. *Behavioral Science*, *7*(2), 211-222.

Hossein, J., & John, W. (2006).Infrastructure and Poverty,Cross Country Evidence. *Poverty Strategies in Asia*,124-144.

JBIC. (2004). *Infrastructure Development and Poverty Reduction.* Tokyo: Japan Bank for International Cooperation.

Jolliffe, I. T., & Cadima, J. (2016). Principal Component Analysis: A Review and recent Developments. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, *374*(2065).

Karine, M.(2014). *The Impact on Remittances in Developing Countries.* Brussells: European Parliament.

Kirkpatrick, C. P.T. (2008). Infrastructure Regulation and Poverty Reduction in Developing Countries: A Review of the Evidence and a Research Agenda. *The Quarterly Review of Economics and Finance, 48(2),*177-188.

Makkik, S., Ghani, N., & Sultan, M. (2005). Pakistan Development. *Pakistan Development Review, 44*(5), 697-614.

Marinho, E. (2017). Impact of Infrastructure Expenses in Strategic Sectors for Brazilian Poverty. *EconimiA*, 18(2), 244-259.

OECD. (2007). Scaling up and Improving Infrastructure for Poverty Reduction. Organization for Economic Co-Operation and Development.

Pekovic, D. (2017). The Effects of Remittances on Poverty Alleviation in Transition Countries. *Journal Of International Studies*, 10(4),37-46.

Pouliquen, L.Y.(2000). Infrastructure and Poverty. Background Paper to the World Bank.

Ravallion, M. (2019). *Ethnic Inequality and Poverty in Malaysia Since 1969* (No. w25640). National Bureau of Economic Research.

Rosenstein-Rodan, P.N. (1943). Problems of Industrialization of Eastern and South Eastern Europe, *The Economic Journal* 53, No 210/211, pp.202-211

Sasmal, R., &Sasmal, J. (2016). Public Expenditure, Economic Growth and Poverty Alleviation. *International Journal of Social Economics.*

Saunders, P. (2002). *The Direct and Indirect Effects of Unemployment on Poverty and Inequality.* University of New South Wales Discussion Paper No:118

The Economist. (2019). *The Critical Role of the Infrastructure for the Sustainable Development Goals*. The Economists Intelligence Unit Limited.

Thimilsina, G.R., Hochman, G., & Song, Z (2020). Infrastructure, Economic Growth, and Poverty: A Review. *World Bank Policy Research Working Paper 9258*.

UN. (2011). *Infrastructure and Poverty Reduction in Africa.* United Nations Habitat.

UNDP. (2019). *Global Multidimensional Poverty Index 2019.* United Nations Development Program.

UNESCO. (2017).*Global Education Monetaring Report.* Reducing Global Poverty through Universal Primary and Secondary Education.UNESCO Institute for Statistics.

UNFPA. (2014). *Population Dynamics in the LDCs Challenges and Opportunities for Development and Poverty Reduction.* New York: United Nations Population Fund.

Visaria, P. (1981). Poverty and Unemployment in India: An Analysis of Recent Evidence. *World Development, 9(3),* 277-300.

World Bank. (2006). Remittances, Households, and Poverty.World Bank, *Global Economic Prospect.* Washington, DC: World Bank.

World Bank. (2010). Millennium Development Goals after Crisis. Washinton, DC: World Bank.

World Bank. (2017). New Country Classification by Income Level. https://blogs.worldbank.org/opendata/new-country-classifications-income-level-2017-2018(last accessed March 6, 2020).

World Bank.(2018). Education and Poverty. Sustaining Gains in Poverty Reduction and Human Development in the Middle East and North America. 33-46.

World Bank. (2019). *Thailand Economic Monitor.* Inequality, Opportunity and Human Capital. Bangkok, World Bank.

World Bank. (2019). *Understanding Poverty*. https://www.worldbank.org/en/topic/poverty/overview.(last accessed Dec 25, 2019)

Zaure, C. (2007). *Poverty Reduction in Developing Countries via Infrastructure Development and Economic Growth.* Tokyo: Asian Development Bank

Appendix

Appendix 1 Classification of Economies in the Study

Code	Long Name	Income Group	Region
BGD	People's Republic of Bangladesh	Lower middle income	South Asia
IND	Republic of India	Lower middle income	South Asia
IDN	Republic of Indonesia	Lower middle income	East Asia & Pacific
PAK	Islamic Republic of Pakistan	Lower middle income	South Asia
PHL	Republic of the Philippines	Lower middle income	East Asia & Pacific
LKA	Democratic Socialist Republic of Sri Lanka	Lower middle income	South Asia
THA	Kingdom of Thailand	Upper middle income	East Asia & Pacific
MYS	Malaysia	Upper middle income	East Asia & Pacific
VNM	Vietnam	Lower middle income	East Asia & Pacific

Note: Lower middle-income economies are those with a GNI per capita between USD 996 and USD 3,895; Upper middle-income economies are those with a GNI per capita between USD 3,896 and USD 12,055; Source: World Bank List of Economies (2017).

Appendix 2 Variables Description and Data Source

Variable	Description	Source
Access to Electricity *(ae)*	Access to electricity (% of the population with access)	World Bank, Sustainable Energy for All (SE4ALL) database from the SE4ALL Global Tracking Framework led jointly by the World Bank, International Energy Agency, and the Energy Sector Management Assistance Program.
Access to Sanitation *(as)*	Improved sanitation facilities (% of the population with access)	WHO/UNICEF Joint Monitoring Programme (JMP) for Water Supply and Sanitation http://www.wssinfo.org
Access to Water *(aw)*	Improved water source (% of the population with access)	WHO/UNICEF Joint Monitoring Programme (JMP) for Water Supply and Sanitation http://www.wssinfo.org

Personal Remittance *(prem)*	Personal remittances received (% of GDP)	World Bank staff estimates based on IMF balance of payments data, and World Bank and OECD GDP estimate.
Unemployment *(unem)*	Unemployment, total (% of the total labor force) (modeled ILO estimate)	International Labor Organization, ILOSTAT database
Population Growth Rate *(pgr)*	Population growth (annual %)	Derived from the total population. Population source: (1) United Nations Population Division. World Population Prospects: 2017 Revision, (2) Census reports and other statistical publications from national statistical offices, (3) Eurostat: Demographic Statistics, (4) United Nations Statistical Division. Population and Vital Statistics Report (various years), (5) U.S. Census Bureau: International Database, and (6) Secretariat of the Pacific Community: Statistics and Demography Programme.
Gini Coefficient *(gini)*	GINI index (World Bank estimate)	World Bank, Development Research Group http://iresearch.worldbank.org/PovcalNet/index.htm
Literacy Rate *(lit)*	Literacy rate, adult total (% of people ages 15 +)	United Nations Educational, Scientific, and Cultural Organization (UNESCO) Institute for Statistics.
GDP per capita *(gdpc)*	GDP per capita, PPP (constant 2011 international $)	World Bank, International Comparison Program database.
PHC $ 190 *(phc190)*	Poverty headcount ratio at $1.90 a day (2011 PPP) (% of the population)	World Bank, Development Research Group. http://iresearch.worldbank.org/PovcalNet/index.htm
PHC $ 320 *(phc320)*	Poverty headcount ratio at $3.20 a day (2011 PPP) (% of the population)	World Bank, Development Research Group. http://iresearch.worldbank.org/PovcalNet/index.htm

Source: Author

Appendix 3 Access to Infrastructure and Poverty Reduction

Variable	All Countries		LMIC		UMIC	
	Phc190	Phc320	Phc190	Phc320	Phc190	Phc320
Access to Electricity	-0.5074***	-0.9090***	-0.3691***	-0.5268***	-0.2353***	-1.1362***
t-Statistic	(-10.74)	(-12.39)	(-6.62)	(-7.36)	(-11.66)	(-18.27)
R^2	0.35	0.64	0.21	0.26	0.74	0.87
Access to Sanitation	-0.6275***	-1.1140***	-0.6613***	-0.9731***	-0.5378***	-2.6571***
t-Statistic	(-25.04)	(-37.78)	(-16.69)	(-22.39)	(-6.75)	(-8.54)
R^2	0.74	0.87	0.63	0.76	0.48	0.60

Access to Water	-1.5312***	-2.6510***	-1.3082***	-1.7092***	-0.5313***	-2.6571***
t-Statistic	(-15.86)	(-17.73)	(-10.00)	(-9.30)	(-9.83)	(-8.54)
R^2	0.54	0.61	0.38	0.36	0.66	0.60
Periods Included	26	26	26	26	26	26
Cross-sections included	9	9	7	7	2	2
(unbalanced) observations	215	215	165	165	50	50

Note: LMIC- Lower middle-income countries, UMIC- Upper Middle-income countries *** significant at 1%, Phc190-Poverty headcount ratio at $1.90 a day (2011PPP) (% of population), Phc320- Poverty headcount ratio at $3.20 a day (2011PPP) (% of population)

Source: Author

Appendix 4 Correlation Matrix of the Access to Infrastructure Variable

	Electricity	Sanitation	Water
Electricity	1		
Sanitation	0.5922	1	
Water	0.7076	0.6062	1

Source: Author

Appendix 5 Results of Causality Test of Access to Infrastructure and Poverty Reduction

Null hypothesis	F statistic	Probability
INDAC does not granger cause phc190	5.0062	0.0076*
Phc190 does not granger cause INDAC	0.7399	0.4785
INDAC does not granger cause phc320	8.0351	0.0005*
Phc320 does not granger cause INDAC	0.9929	0.3725
INDLMI does not granger cause phc190	5.3129	0.0059*
Phc190 does not granger cause INDLMI	0.7204	0.4882
INDLMI does not granger cause phc320	5.8963	0.0035*
Phc320 does not granger cause INDLMI	0.2492	0.7798
INDUMI does not granger cause phc190	2.5087	0.0938*
Phc190 does not granger cause INDUMI	0.9574	0.3923
INDUMI does not granger cause phc320	11.2597	0.0001*
Phc320 does not granger cause INDUMI	0.1199	0.8873

Note: INDAC-Access to Infrastructure Index of all sample countries
INDLMI-Access to Infrastructure Index of lower middle-income countries
INDUMI-Access to Infrastructure Index of upper middle-income countries
Phc190-Poverty headcount ratio at $1.90 a day (2011PPP) (% of population)
Phc320- Poverty headcount ratio at $3.20 a day (2011PPP) (% of population)
Source: Author

ISSN 2738-2028 (Online) | Vol. 4 | No. 1 & 2 | 2020 January & July

JBT

Journal of Business and Technology

International peer-reviewed journal | Publish semi-annually

Effects of Perceived Risk and Subjective Norms on Internet Banking Adoption Amongst the Students of University of Kelaniya: A Multilevel Linear Model Analysis

D. A. Gayan Nayanajith[1]* and K. A. Damunupola [2]

[1]Faculty of Graduate Studies, University of Kelaniya, Sri Lanka
[2]Senior Lecturer, Uwa Wellassa University, Sri Lanka
* Corresponding author: dagnsrilanka@gmail.com

ABSTRACT

Challenging technology advancements necessitate robust macroeconomic performance to support overall economic development. Within the service sector of the economy, one of the broadly studied areas of technological transformation is retail financial services; particularly consumer banking activities. Internet banking enables customers to experience a vast array of financial services through e-banking websites. Nonetheless, in practice; this phenomenon is contingent on the particular context. Hence, this research addresses the significance of subjective norms and perceived risk towards acceptance of consumer internet banking in the Sri Lankan context with special reference to private commercial banks. The sample was drawn from the students of the University of Kelaniya those who are participating in the weekend study programs. The students of the Doctor of Business Administration Course attached to the university were selected as enumerators for data collection. Data collected through self-administered questionnaires from the respondents. Initially, 400 questionnaires were distributed and 287 duly completed questionnaires were considered for the final data analysis. TAM has been extended using the subjective norms and perceived risk variables and dimensions of the variables were measured by a five-point Likert scale. Cronbach's alpha was used to check reliability. To test the hypotheses, ANOVA, ANCOVA, and multilevel linear models were used. The empirical evidence supported three hypotheses indicating the significance of the variables/constructs on the adoption of internet banking. In conclusion, the authors have presented several suggestions for research studies, in time to come.

Keywords: *Internet Banking, Online Banking, Risk, Sri Lanka, TAM*

INTRODUCTION

The marginal sectoral performance of the economy has witnessed the vulnerability of the economy to both internal and external disturbances. The services sector is the impetus of the Sri Lankan economy which contributes most, where services related economic activities expanded by 4.7 percent in 2018 in value-added terms in comparison to corresponding 3.6 percent growth which was reported in the preceding year (CBSL, 2019). The progression of service sector activities during the year was essentially backed by the development of financial services activities together with the expansions in wholesale and retail trade activities without causing significant macro-prudential concerns amidst critical market conditions. The banking sector of the country continued to dominate the financial sector, accounting for a considerable 72.5 percent of the total assets of the financial sector (CBSL, 2019). Nevertheless, the profitability of the

banking sector has deteriorated due to the upsurge of operating costs, among other things. Hence, this could be addressed by minimizing operational costs whilst improving additional income sources concurrently by facilitating electronic onboarding via internet banking services.

In the meantime, retaining public trust whilst providing safe and secured financial services, is vital for the proper functioning of the market mechanism (CBSL, 2019). Timely addressing of various aspects of risks embed innovation, service quality enhancement, and secure services provision, are paramount in improving the internet banking adoption levels within the Sri Lankan banking context (Commercial Bank of Ceylon, 2019; HNB PLC, 2018; Sampath Bank PLC, 2018). Furthermore, several researchers have noted the significance of perceived risk and subjective norms factors concerning the adoption of internet banking within different country contexts (Al-Ajam & Nor, 2015; Gumussoy et al., 2018; Marakarkandy et al., 2017; Kamyab & Delafrooz, 2016). In the same way, numerous researchers have recognized the strategic importance of conducting researches on the notion of internet banking adoption related to various emerging and developing country perspectives (Afshan et al., 2018; Gayan Nayanajith & Dissanayake, 2019; Rahi, 2015).

Moreover, researches related to technology adoption have identified different impacts alongside observing varied relationships between the factors affecting the adoption of novel technologies and the adoption aspect itself. Similarly, some researchers have identified significant relationships among the perceived risk, subjective norms, perceived ease of use, perceived usefulness, and internet banking adoption whereas some other studies have found such relationships are not significant in different country contexts (Al-Ajam & Nor, 2015; Boateng et al., 2016; Marakarkandy, Yainik & Dasgupta, 2017; Nor & Pearson, 2015; Rawashdeh, 2015).

THEORETICAL BACKGROUND AND LITERATURE REVIEW

Aldás-Manzano et al. (2009) noted how innovativeness could be used to positively influence online banking adoption and reducing consumer perceived risk. Further, Lee (2009) indicated that intention to use online banking is adversely affected mainly by the security/privacy risk, as well as financial risk, according to the research integrating TAM and TPB models. Additionally, several researchers showed that behavioral intention is significantly influenced by perceived usefulness, perceived ease of use, and perceived risk (Risk) in the Jordanian mobile banking context (Alalwan et al., 2016). Some researchers indicated that TAM constructs, perceived risk elements, innovativeness, subjective norms, perceived behavioral control, perceived security and trust of e-services are predictors of behavioral intention/adoption towards e-banking (Giovanis et al., 2012; Gayan Nayanajith & Damunupola, 2019; Nayanajith & Damunupola, 2019a & 2019b; Nayanajith, Damunupola & Ventayen, 2019a; Nayanajith, Damunupola & Pastor, 2020).

Poon (2008) indicated that privacy, security, and convenience factors play a significant role in determining users' acceptance of e-banking services. Perceived technology security was the most important factor, inter alia, to decide the user's intention concerning the adoption of e-banking (Rahi & Ghani, 2018). Security is the extent to which the user believes that using an application will be risk-free (safe) and the capability to protect data against unauthorized access (Kim et al. 2010; Zeithaml et al. 2000; Shareef et al. 2011). Charney (2008) suggested that the principal purpose of security is to protect the data and system. There are several aspects to consider to reduce information security risk and uplift the security of same (Lai, Tong & Lai, 2011; Weippl, 2005; Taherdoost et al., 2011). A research study conducted in Finland in the light of the technology acceptance model (TAM) by Pikkarainen et al. (2004) proposed that online banking adoption or acceptance can be modeled with the TAM variables perceived usefulness and perceived ease of

use (PU & PEOU) with four other variables referred as perceived enjoyment (PE), information on online banking, security and privacy, and the quality of the internet connection variables as derived from the available online banking acceptance literature. The study conducted by Priyangika, Perera, and Rajapakshe (2016) mainly focused on the analysis of customers' attitude towards internet banking under four factors (TAM with two additional factors); PEOU, PU, perceived risk (PR), and subjective norms (SN). Attitude towards online banking has strong positive relationships with PEOU and PU while PR and the SN have weak positive relationships.

CONCEPTUAL FRAMEWORK AND HYPOTHESES OF THE STUDY

The technology acceptance model (TAM) is an extension of Ajzen and Fishbein's theory of reasoned action (TRA) as found in the literature. Davis's TAM (Davis, 1989; Davis, Bagozzi, & Warshaw, 1989) is applied extensively to explain users' acceptance and usage of technology (Venkatesh, 2000). TAM was developed by Fred Davis and Richard Bagozzi (Davis 1989; Bagozzi, Davis & Warshaw 1992). TAM is an adaptation of TRA for the field of information systems. TAM was originally used to examine internet banking (IB) adoption by Bhattacherjee (2001). His research examined a post-acceptance application of TAM to understand the role of expectations in IB adoption and continued use among United States banking customers. Another remarkable application of TAM in the study of IB adoption was presented by Suh and Han (2002 & 2003) who were the first to consider cross-national effects in their study of South Korean e-banking customers. Another prominent study was conducted by Vatanasombut, Igbaria, Stylianou, and Rodgers (2008) who integrated TAM and commitment trust theory to understand continuance intentions. Attempts to extend TAM (e.g., TAM2) have generally guided largely by one of the three following approaches: by integrating factors from interconnected models on customer adoption, by means of integrating additional or alternative belief factors, and lastly by way of examining antecedents and moderators of perceived usefulness and perceived ease of use.

In the present study, TAM has been extended by using additional variables as one of the means of extending Davis's model (Hanafizadeh, Keating & Khedmatgozar, 2014). Variables such as perceived risk, subjective norms have already been used in an attempt to extend the TAM (Gumussoy, Kaya & Ozlu, 2018; Lee, 2009; Sanayei & Bahmani, 2012). The relationship between attitudes and SN has been noted although the causality has not been established (Ajzen, 1985; Sheppard, Hartwick & Warshaw, 1988). Similarly, PEOU, PU, have been identified as the immediate direct determinants of customers' attitudes towards the adoption of internet banking (Abdekhoda et al., 2015; Celik, 2008). Hence, the adopted conceptual model is consistent with the theories. Some researchers noted that e-banking adoption could be analyzed by extending the TAM along with predictor variables such as perceived security of e-services, the perceived trust of e-services, perceived risk, and similar variables even in the context of Sri Lanka (Gayan Nayanajith & Dissanayake; 2019; Nayanajith et al., 2019b & 2019c). Considering the aforesaid facts following conceptual model has been proposed for the research.

CONCEPTUAL MODEL

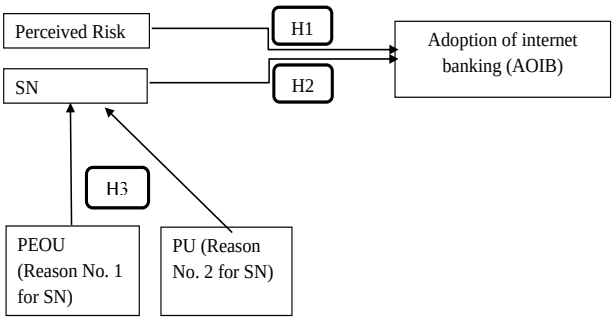


Figure 1: Conceptual model

Slade, Dwivedi, Piercy, and Williams (2015) revealed that performance expectancy, social influence, innovativeness, and perceived risk significantly influenced nonusers' intentions

to adopt remote mobile payments, according to the research conducted in the UK on modeling consumers' adoption intentions of remote mobile payments. Priyangika et al. (2016) noted that attitude towards online banking has strong positive relationships with PEOU and PU while PR and the SN have weak positive relationships. Lee (2009) indicated that the intention to use internet banking is adversely affected mainly by different kinds of risks. Alalwan et al. (2016) showed that behavioral intention is significantly influenced by perceived usefulness, perceived ease of use, and perceived risk. TAM constructs and perceived risk elements drive behavioral intention towards internet banking adoption (Giovanis, et al., 2012).

Considering the aforementioned facts following hypothesis was proposed,

H1-Perceived risk predicts AOIB significantly

Al-Ajam and Md Nor (2015) identified that customers' behavioral intention was significantly influenced by attitude, subjective norms, and technology readiness, in the Yemeni online banking adoption context. Among other factors, Perceived e-security, PEOU, PU, and SN are several influential factors that explain the e-banking adoption in Sri Lanka (Gayan Nayanajith & Dissanayake, 2019; Gayan Nayanajith & Damunupola, 2019). Another research effected by Deb and David (2014) found empirical evidence for the positive relationship between PU, PEOU, and social influence on positive attitude towards mobile banking in the Indian context. A subsequent study conducted on the adoption of e-banking in the same country by Rakesh and Ramya (2014) has identified empirical evidence for the positive relationship between PU, PEOU, and social influence on positive attitude towards mobile banking in the context of India. Several researchers claimed that the variables of perceived security and trust in e-banking had a significantly positive impact on the adoption of e-banking (Lim et al., 2019; Damghanian et al., 2016; Masoud & AbuTaqa (2017).

Considering the aforementioned facts following hypothesis was proposed,

H2-SN predicts AOIB significantly

According to Featherman and Hajli (2016) as usage risk concerns increased, the effect of subjective norm on PU and intention to use an e-service strengthened, as per the research on self-service technologies. Some researchers noted the significance of perceived ease of use and some other variables towards the adoption of e-services and another researcher particularly noted that PU, PEOU, and SN affect internet banking adoption (Nayanajith et al., 2019d & 2019e; Yousefi, 2015 as cited by Rajapakse, 2017). Moreover, Rakesh and Ramya (2014) have identified empirical evidence for the positive relationship between PU, PEOU, and social influence on positive attitude towards mobile banking in the context of India. Nayanajith and Damunupola (2019a) noted that the security of e-services, the interaction of subjective norms, and reason towards the same, are significant on online banking adoption in the Sri Lankan context.

Considering the aforementioned facts following hypothesis was proposed,

H3- Interaction of SN and R predicts AOIB significantly

Upon reviewing the literature operationalization of the variables, was conducted and the overview of the same is given in the following table (Table 1a).

Table 1a: Operationalization Table

Concept	Variable	Measurement indicator	Source
Technology acceptance	Perceived usefulness	The belief that using a particular system (online banking) will enhance job performance	Davis et al., 1989
	Perceived ease of use	The belief that using a particular system will be free from effort	
Technology acceptance	Adoption of internet banking	Usage of e-banking	Aldas-Manzano et al., 2009: Davis, 1989; Venkatesh, 2000; Poon, 2007
		Customers' intention to use	
Perceived risk theory	Perceived risk in internet banking	Likelihood of financial loss-financial risk	Aldas-Manzano et al., 2009; Khedmatgozar & Shahnazi, 2017
		Likelihood of wasting time, online-time risk	
		Likelihood of poor performance of service-performance risk	
		Likelihood of fraud & misuse of data-security risk	
		Possibility of abuse of personal information-privacy risk	
		Negative attitudes of social groups towards the service-social risk	
Theory of reasoned action	Subjective norms	Specific perceived social pressure to perform or not to perform the behavior (usage of internet banking) by an individual	Fishbein, 1976; Fishbein & Ajzen, 1975; Albarracin & Ajzen, 2007

RESEARCH METHOD

In this study deductive methodology and quantitative methods have been used. Firstly, a questionnaire survey was deemed suitable for the type of data that the researcher gathered as the major part of the study is concerned with the respondents' perceptions of e-banking and how these perceptions influence their adoption of e-banking. Secondly, Saunders (2011) specified that questionnaires can be employed to examine and explicate relationships between variables. There were additional reasons to use a questionnaire survey, including the need for a large sample and the fact that the cost of a questionnaire survey is much cheaper than against an interview survey. Respondents of this research study were the students of the University of Kelaniya who were participating in the weekend study programs conducted by the university and are possessing internet banking facilities offered by the private commercial banks. They were selected on a random sampling method as per registration numbers. The doctoral students of the Doctor of Business Administration (DBA) attached to the university, were selected as enumerators for the data collection process. They have collected data through self-administered questionnaires from the respective respondents. Altogether 400 questionnaires were distributed and 287 duly completed questionnaires were considered for the final data analysis.

RESULTS

The IBM SPSS 20 package was used for data analysis. The sample consisted of a higher proportion of male respondents (51.6 percent) than female respondents (48.4

percent). Further, the majority being 65.8 percent of the respondents were advanced level qualified personnel and 11 percent of the respondents were qualified as graduates whereas postgraduate and professional qualification holders were recorded as 9 percent and 14.2 percent respectively. As per the age distribution statistics, the vast majority of respondents (64.5 percent) were aged between 30–60 years where married respondents count reported as 65.8 percent in considering the marital status. Given the figures of the analysis 65.2 percent recorded in the income segment in between Rs.75,000/- to Rs.150,000/- Therefore, the demographic characteristic structure of the research sample is in line to examine the research issue in the particular context as most of the demographic features of the population are being replicated by the designated sample of the research study.

Initially, a reliability analysis was conducted to measure internal consistencies of the total scores for each scale through Cronbach's alpha coefficients (Field, 2017). The calculation of reliability measurements is presented in table 1b. As per the findings, all the reliabilities for variables are found to be adequate since Cronbach's alpha values are higher than 0.7 (George & Mallery, 2003). Moreover, the K-S test, Levene's test, and linearity test performed to ensure normality, homoscedasticity, and linearity respectively, in which the results were not significant for the tests.

Table 1b: Reliability Analysis of the Variables.

	No. of items	Cronbach's alpha	Mean	Standard deviation
SN	6	.819	3.95	.46
Risk	24	.915	3.81	.58
AOIB	8	.879	4.19	.49

Source: Survey data 2019

According to the descriptive statistics as depicted in table 1b, variables are at a high level as the composite mean figures are all above 3.66 (where 5 point Likert scale figures starting from strongly agree, agree, not sure, disagree and strongly disagree, have been converted to high, medium and low values in the following manner (taking account of the composite values calculated by using SPSS application), values in between 1-2.33, considered as low; 2.34-3.66, medium; 3.67-5, high, respectively). There were six constructs for the Risk variable and subsequently the composite mean was recorded at 3.81 whereas the S variable has a composite mean of 3.5, while the dependent variable; AOIB has reported a mean of 4.19.

Table 1c shows the results of one-way ANOVA, analyzing the effect of SN on AOIB, which is significant, F (1, 285) = 15.614, p = .000

Table 1c: ANOVA Results

	Sum of Squares	*df*	Mean Square	*F*	Sig.
Between Groups	2.928	1	2.928	15.614	.000
Within Groups	53.448	285	.188		
Total	56.377	286			

Source: Survey data 2019

Table 2 shows the results of the multilevel linear model (MLM) with only the fixed effect of SN, which is significant and similar to ANOVA, F (1, 285) = 15.614, p = .000

Table 2: MLM Results

Type III Tests of Fixed Effects[a]

Source	Numerator *df*	Denominator *df*	*F*	Sig.
Intercept	1	287	3625.973	.000
Subjective Norm (Sub. N.)	1	287	15.723	.000

a. Dependent Variable: AOIB.

Source: Survey data 2019

Table 3 demonstrates the results of ANCOVA with Risk as a covariate in determining the effect of SN on AOIB. Now, SN does not predict AOIB significantly, F (1, 284) = .748, p = .388. However, there is a significant effect of Risk on AOIB, F (1, 284) = 634.65, p = .000.

Table 3: ANCOVA Results

Tests of Between-Subjects Effects

Dependent Variable: AOIB

Source	Type III Sum of Squares	*df*	Mean Square	*F*	Sig.
Corrected Model	39.853[a]	2	19.926	342.488	.000
Intercept	35.459	1	35.459	609.450	.000
Risk	36.925	1	36.925	634.647	.000
Sub. N.	.044	1	.044	.748	.388
Error	16.524	284	.058		
Total	5726.500	287			
Corrected Total	56.377	286			

a. R Squared = .707 (Adjusted R Squared = .705)

Source: Survey data 2019

Table 4 depicts the results of MLM with fixed effects of SN and Risk. Even now, SN is not significant although the Risk is significant which is similar to previous ANCOVA results.

Table 4: Reliability Analysis of the Variables

Estimates of Fixed Effects[a]

Parameter	Estimate	Std. Error	*df*	*t*	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	2.2480	.107701	287	20.873	.000	2.036059	2.460029
Sub. N.	-.02545	.029284	287	-.869	.385	-.083099	.032180
Risk	.590894	.023333	287	25.325	.000	.544969	.636819

a. Dependent Variable: AOIB.

Source: Survey data 2019

Table 5 demonstrates the results of MLM with a level 2 variable which is the particular bank of the respondent. This considers the covariation within banks by including the hierarchical data structure and assumes that intercepts vary across banks. Allowing the intercepts to vary has made a difference to the model. Chi-square change (-2LL change) = -4.827 - -69.968 = 65.141, df change = 5-4 = 1, chi-square critical values with 1 df is 3.84 ($p < .05$) and 6.63 (p

< .01); therefore, this change is highly significant; the fit of the model has significantly improved. Hence, it could be noted that the intercepts for the relationships between SN and AOIB (when controlling for Risk) vary significantly across the different banks. By allowing the intercepts to vary, there is a new regression parameter for the effect of SN, which is .15 compared to -.03 when the intercept was fixed. In other words, by allowing the intercepts to vary over banks, the effect of SN has become slightly higher positive from the previous lower negative one. In fact, now SN is significant, F (1, 285.55) = 19.97, p = .000. This shows how had the researchers ignored the hierarchical structure in the data, researchers would have been reached different conclusions than what is mentioned in this section.

Table 5: MLM with Level 2 Variable (Random Intercepts-Banks) Results

Estimates of Fixed Effects[a]

Parameter	Estimate	Std. Error	*df*	*t*	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	1.83480	.134014	31.515	13.691	.000	1.561661	2.107947
Sub. N.	.153149	.034271	285.545	4.469	.000	.085694	.220604
Risk	.629412	.021344	285.039	29.489	.000	.587400	.671423

a. Dependent Variable: AOIB.

Source: Survey Data 2019

Including a random intercept has changed log-likelihood significantly. Hence, Table 6 shows the results with the addition of random slope. Chi-square change (-2LL change) = -69.968 - -116.427 = 46.459, *df* change = 6-5 = 1, chi-square critical values with 1 *df* are 3.84 ($p < .05$) and 6.63 ($p < .01$); therefore, this change is highly significant; the fit of the model has significantly improved when the variance of slopes is included; meaning that there is significant variability in slopes.

Table 6: MLM with Random Intercepts (Banks) and Random Slopes (SN) Results

Estimates of Fixed Effects[a]

Parameter	Estimate	Std. Error	*df*	*t*	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	1.75070	.193196	7.595	9.062	.000	1.301026	2.200388
Sub. N.	.203444	.114150	4.157	1.782	.147	-.108809	.515698
Risk	.634581	.019406	283.545	32.701	.000	.596383	.672778

a. Dependent Variable: AOIB.
Source: Survey data 2019

As there is significant variability in slopes, subsequently check whether the slopes and intercepts are correlated (or covary). In the previous analysis 'variance components' assumed covariance between intercepts and slopes were zero. Hence, only the variance of slopes has been estimated. Now, covariance being included by selecting 'unstructured', and results given in table 7.

Chi-square change (-2LL change) = -116.427 - -121.408 = 4.981, *df* change = 7-6 = 1, chi-square critical values with 1 *df* is

3.84 ($p < .05$) and 6.63 ($p < .01$); fit not improved at $p < .01$, now SN is Not Significant, $p = .269$, However, Risk is Significant, $p = .000$, variance estimates for the intercept (.113) and slopes (.043) and their associated significance (-.061) (covariance of slopes and intercepts) based on Wald test, confirms this, as all the estimates are not significant. As the covariance is negative, it indicates a negative relationship between the intercepts and slopes. Since the research is looking at the effect of SN on AOIB in 4 different banks, this means that, across these banks, as the intercept for the relationship between SN and AOIB increases, the value of the slope decreases.

The variance of the slopes (.043) indicates that how much the slopes vary around a single slope fitted to the entire data set (i.e., ignoring the bank from which the data emanated). This confirms what the chi-square test illustrated; that the slopes across banks are not significantly different.

Therefore, could be concluded then, that the intercepts and slopes for the relationship between SN and AOIB (when controlling for Risk) do not vary significantly across the different banks. By allowing the intercept and slopes to vary there is also a new regression parameter for the effect of SN, which is .159 compared to .153 when the slopes were fixed. In other words, by allowing the intercepts to vary over banks, the effect of SN has increased very slightly and it is still not significant, F (1, 3.592) = 1.709, $p = .269$. This demonstrates that even if the hierarchical structure in data, has been ignored the same conclusion would have been reached in this scenario, as per the analysis.

Table 7: MLM with Covariance between Intercepts and Slopes

Estimates of Covariance Parameters[a]

Parameter		Estimate	Std. Error	Wald Z	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Residual		.03521	.00297	11.825	.000	.029835	.041561
Intercept + Sub. N.	UN (1,1)	.11306	.09275	1.219	.223	.022647	.564483
[subject = Question	UN (2,1)	-.0614	.05475	-1.123	.261	-.168804	.045828
4_Bank]	UN (2,2)	.04351	.03663	1.188	.235	.008356	.226638

a. Dependent Variable: AOIB.

Source: Survey data 2019

When the R and interaction of R x SN, were introduced to the model, results are as follows. Chi-square change (-2LL change) = -121.408 - -187.098 = 65.69, *df* change = 9-7 = 2, chi-square critical values with 2 *df* is 5.99 ($p < .05$) and 9.21 ($p < .01$); fit improved, now SN is Significant, $p = .034$, Risk is also Significant, $p = .000$, R is Significant, $p = .049$, SN x R is also Significant, $p = .000$, regression coefficient of SN = .425, All predict AOIB, Values of variables of intercepts/slopes and covariance are not significant. Interaction term shows the most interesting effect, since this shows the effect of R for SN, taking account of whether or not the respondent had SN (Table 8).

Table 8: MLM with the Addition of Reason (R) towards SN and Interaction (R*SN)

Estimates of Fixed Effects[a]

Parameter	Estimate	Std. Error	*df*	*t*	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	1.87783	.261170	17.904	7.190	.000	1.328922	2.426741
Sub. N.	.425807	.148915	5.139	2.859	.034	.046101	.805514
Risk	.571683	.024157	283.43	23.665	.000	.524133	.619234
R	.153230	.077619	280.25	1.974	.049	.000439	.306021
Sub.N.*R	-.21992	.045524	280.08	-4.831	.000	-.309542	-.130315

a. Dependent Variable: AOIB.

Source: Survey Data 2019

For the respondents those with SN considering PEOU, SN did not significantly predict AOIB, b = .113, t (3.949) = .905, p =.417. The positive gradient showed that in these people, AOIB is higher after the SN compared to the control group. Further, for those who had SN considering PU also, SN did not predict AOIB, b = -.0630, t (27095.493) = -.217, p =.828. However, the slope was negative, indicating that people who had SN considering PU, scored lower on AOIB, than those who did not have SN (Although this is not significant). The interaction effect, hence, reflects the difference in slopes for SN as a predictor of AOIB in those who had SN considering PEOU (slight positive slope) and those who had SN considering PU (slight negative slope). In conclusion, it could be noted that AOIB, after controlling for Risk, was lower for those who had SN considering PU than those who had SN considering PEOU. This senses that for those who had SN considering PEOU, the SN has probably brought easiness, and therefore, their adoption increase while those had SN considering PU, may get to know that usefulness was not the cause for non-adoption, and hence, their AOIB is lower.

Table 9: MLM Rerun Results, Separately for Different 2 Reasons by Removing R and Interaction of R and SN by Splitting the File

Sub. N. considering PEOU

Estimates of Fixed Effects[a,b]

Parameter	Estimate	Std. Error	*df*	*t*	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	2.32346	.238606	9.995	9.738	.000	1.791783	2.855153
Sub. N.	.113819	.125827	3.949	.905	.417	-.237320	.464958
Risk	.525894	.027650	187.694	19.020	.000	.471349	.580438

a. R = PEOU

b. Dependent Variable: AOIB.

Sub. N. considering PU

Estimates of Fixed Effects[a,b]

Parameter	Estimate	Std. Error	*df*	*t*	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	3.18838	.363902	27751.58	8.762	.000	2.475118	3.901647
Sub. N.	-.06302	.290607	27095.49	-.217	.828	-.632626	.506584
Risk	.327727	.008926	91.127	36.715	.000	.309996	.345458

a. R = PU

b. Dependent Variable: AOIB.

Source: Survey Data 2019

DISCUSSION OF RESULTS

Statistical tests such as ANOVA, ANCOVA, Multilevel Linear Model (MLM) were used enabling to answer the research question (are SN, Risk, and interaction effect significantly predict adoption of internet banking?) and testing of the hypotheses as per the necessity. Although MLM could have been used to test the hypotheses in a complicated manner, researchers had developed MLM gradually to measure the differences in the output when the hierarchy (from individual internet banking user level to internet banking users considering the particular bank to which the users belong), random intercept, random slope and covariance of random intercepts and random slopes were introduced. Hence, in the beginning, MLM was conducted considering only the SN without any hierarchical structure that is similar to performing of ANOVA test. Subsequently, enabling to analyze the effect of 'Risk' on the adoption of internet banking (AOIB) while taking account of SN, conducted the analysis again ignoring the data structure, and output was similar to that of performing of ANCOVA analysis. Afterward, the model was developed further and as shown in table 8-MLM with the addition of reason (R) towards SN and interaction (R*SN) test was conducted. As depicted in the output of same, SN, Risk and interaction effect were significant and all the three hypotheses were supported by the empirical results attaining the objective (to identify the effect of SN, Risk and interaction effect, on AOIB) of the study. Finally, intending to identify the effect of SN considering the two reasons (R) namely; PEOU and PU, MLM was re-run, by splitting the file.

To summarize, consistent with the empirical results given in the preceding section, AOIB has been significantly predicted by SN as per ANOVA results. However, in ANCOVA with Risk as the covariate, SN was not significant in predicting AOIB. Both MLMs of random intercepts and random intercepts with random slopes showed that Risk is significant and SN is significant only in the random intercepts model. MLM assuming the covariance of random intercepts and random slopes showed that model fit has not been increased significantly at $p = .01$ level. Additionally, there are empirical evidences to support a positive relationship between adoption and perceived risk of e-services variables on e-banking adoption (Perera, 2013). With the addition of R and interaction of R and SN to MLM, SN, Risk, R, and interaction all predicted AOIB significantly. According to the final MLM, it could be noted that AOIB, after controlling for Risk, was lower for those who had subjective norms considering perceived usefulness than those who had subjective norms in view of perceived ease of use, although the effect is not statistically significant in this context.

CONCLUSION

The present study was executed to determine the significance of SN, perceived risk, R, and interaction of SN and R on AOIB in the context of the top four private commercial banks in Sri Lanka, where the data had two levels of hierarchy; i.e. individual and bank. MLM with random slopes, random intercepts with provisions for the covariance of random intercepts, and random slopes illustrated that SN, Risk, R, and interaction of R and SN, all predict AOIB significantly. The interaction effect indicated that the difference in slopes for SN as a predictor for AOIB, in those who had SN considering PEOU; slightly positive slope and those who had SN considering PU; slightly negative slope. The empirical evidence supported the first and second hypotheses suggesting the significance of SN, Risk on AOIB. Moreover, the interaction of SN and R also significantly predicted AOIB being the third hypothesis.

Results of the study were indicative that perceived risk and subjective norms are significantly predicting the adoption of internet banking in the present research context. Hence, internet banking service providers; particularly commercial banks ought to pay their special attention to address the internet banking users' concerns on perceived risk towards patronizing specific internet banking services such as higher value fund transfers, the opening of fixed deposit accounts, execution of online investments, etc. While promoting the online banking services, commercial banks could emphasize

the measures taken by them to mitigate probable financial losses, time-saving and convenient nature of internet banking services, the superior service performance of online amenities, strengthened data security and data protection initiatives, maintenance of highest standards related to privacy concerns and highly regarded favorable societal attitudes concerning the adoption of internet banking services enabling to overcome the associated perceived risks (Khedmatgozar & Shahnazi, 2017). Correspondingly, internet banking service operators are required to identify the significance of determinants of behavioral intentions and ascertain the way how the perceptions of relevant groups or individuals for instance the family members, friends, and peers, affect one's performance of/adoption of internet banking services (Aldas-Manzano et al., 2009). Conforming to the present and previous research findings, internet banking service providers could use pull and push marketing strategies as well as customer orientation and technical strategies in view of upgrading the internet banking adoption level amongst the Sri Lankans. Similarly, it is recommended to execute the marketing communication campaigns highlighting the safe and secured, ease of use features of the internet banking facilities which is a necessity for the busy lifestyles of the contemporary technology-savvy society (Aldas-Manzano et al., 2009; Alalwan et al., 2016; Khedmatgozar & Shahnazi, 2017; Priyangika et al., 2016).

Limitations which confine the reliability to generalize the research findings could be noted as the respondents of the study were the students of the University of Kelaniya those who are participating in the weekend study programs of the university, it could be possible to obtain different results in the case of conducting the research in another context as the respondents may not exactly replicate the whole Sri Lankan online banking customers of the selected commercial banks. Since there were constraints due to time and sample selection, future researches could be performed with an enriched representation of the entire population to validate the research findings in search of diverse findings in diverse country, cultural and social-economic contexts by integrating a wide array of adoption models, predictor variables and perspectives.

References

Abdekhoda, M., Ahmadi, M., Gohari, M., & Noruzi, A. (2015). The effects of organizational contextual factors on physicians' attitude toward adoption of Electronic Medical Records. *Journal of biomedical informatics*, *53*, 174-179.

Afshan, S., Sharif, A., Waseem, N., & Frooghi, R. (2018). Internet banking in Pakistan: an extended technology acceptance perspective. *International Journal of Business Information Systems, 27(3),* 383-410.

Al-Ajam, A. S., & Md Nor, K. (2015). Challenges of adoption of internet banking service in Yemen. *International journal of bank marketing*, *33*(2), 178-194.

Alalwan, A. A., Dwivedi, Y. K., Rana, N. P., & Williams, M. D. (2016). Consumer adoption of mobile banking in Jordan: examining the role of usefulness, ease of use, perceived risk and self-efficacy. *Journal of Enterprise Information Management*, *29*(1), 118-139.

Albarracin, D., & Ajzen, I. (2007). Predicting and changing behavior: A reasoned action approach. *Prediction and Change of Health Behavior: Applying the Reasoned Action Approach. Lawrence Erlbaum Associates, Mahwah, NJ*, 3-21.

Aldás-Manzano, J., Lassala-Navarré, C., Ruiz-Mafé, C., & Sanz-Blas, S. (2009). The role of consumer innovativeness and perceived risk in online banking usage. *International Journal of Bank Marketing*, *27*(1), 53-75.

Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In Action control (pp. 11-39). Springer, Berlin, Heidelberg.

Bagozzi, R. P., Davis, F. D., & Warshaw, P. R. (1992). Development and test of a theory of technological learning and usage. *Human relations*, *45*(7), 659-686.

Bhattacherjee, A. (2001). An empirical analysis of the antecedents of electronic commerce service continuance. *Decision support systems*, *32*(2), 201-214.

Boateng, H., Adam, D. R., Okoe, A. F., & Anning-Dorson, T. (2016). Assessing the determinants of internet banking adoption intentions: A social cognitive theory perspective. Computers in Human Behavior, 65, 468-478.

Celik, H. (2008). What determines Turkish customers' acceptance of internet banking?. *International Journal of Bank Marketing*.

Central Bank of Sri Lanka, 2019. *Annual Report, 2018*.

Charney, S., & Computing, T. (2008). Establishing end to end trust. *The Microsoft Corporation*.

Commercial Bank of Ceylon PLC, 2019. *Annual Report, 2018*.

Damghanian, H., Zarei, A., & Siahsarani Kojuri, M. A. (2016). Impact of perceived security on trust, perceived risk, and acceptance of online banking in Iran. *Journal of Internet Commerce*, *15*(3), 214-238.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS quarterly*, 319-340.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: a comparison of two theoretical models. *Management science*, *35*(8), 982-1003.

Deb, M., & Lomo-David, E. (2014). An empirical examination of customers' adoption of m-banking in India. *Marketing Intelligence & Planning*, *32*(4), 475-494.

Featherman, M. S., & Hajli, N. (2016). Self-service technologies and e-services risks in social commerce era. *Journal of Business Ethics*, *139*(2), 251-269.

Field, A. (2017). *Discovering statistics using IBM SPSS statistics: North American edition*. Sage.

Fishbein, M. (1976). A behavior theory approach to the relations between beliefs about an object and the attitude toward the object. In *Mathematical Models in Marketing* (pp. 87-88). Springer, Berlin, Heidelberg.

Fischbein, M., & Ajzen, I. (1975). *Belief, attitude, intention and behavior*. Addison-Wesley.

Gayan Nayanajith, D. A. & Damunupola, K. A. (2019a) " E-Service Trustworthiness and Adoption of Online Banking in the Presence of a Moderator: A Relational Study", Journal of Environmental Science, Computer Science and Engineering & Technology, Vol.8 Issue:4,pp.265-289,DOI:10.24214/jecet.B.8.4.26589

Gayan Nayanajith, D. A. & Dissanayake, D. M. R. (2019) "E-Banking Adoption in the Context of Innovation and E-Service Quality: A Review on Concepts and Practices", Journal of Environmental Science, Computer Science and Engineering & Technology, Vol.8 Issue:3, pp.208-221, https://doi.org/10.1108/02652320310457776

George, D., & Mallery, M. (2003). Using SPSS for Windows step by step: a simple guide and reference.

Giovanis, A. N., Binioris, S., & Polychronopoulos, G. (2012). An extension of TAM model with IDT and security/privacy risk in the adoption of internet banking services in Greece. *EuroMed Journal of Business*, *7*(1), 24-53.

Gumussoy, C. A., Kaya, A., & Ozlu, E. (2018). Determinants of mobile banking use: an extended TAM with perceived risk, mobility access, compatibility, perceived self-efficacy and subjective norms. In *Industrial Engineering in the Industry 4.0 Era* (pp. 225-238). Springer, Cham

Hanafizadeh, P., Keating, B. W., & Khedmatgozar, H. R. (2014). A systematic review of Internet banking adoption. *Telematics and informatics*, *31*(3), 492-510.

Hatton National Bank PLC, 2019. *Annual Report, 2018*.

Kamyab, M., & Delafrooz, N. (2016). Investigating the effect of personality traits, subjective norms and perceptions of customers on using internet banking. *Indian Journal of Science and Technology, 9(1)*, 1-8.

Khedmatgozar, H. R., & Shahnazi, A. (2018). The role of dimensions of perceived risk in adoption of corporate internet banking by customers in Iran. *Electronic Commerce Research*, *18*(2), 389-412.

Kim, C., Tao, W., Shin, N., & Kim, K. S. (2010). An empirical study of customers' perceptions of security and trust in e-payment systems. *Electronic commerce research and applications*, *9*(1), 84-95.

Lai, I. K., Tong, V. W., & Lai, D. C. (2011). Trust factors influencing the adoption of internet-based interorganizational systems. *Electronic Commerce Research and Applications*, *10*(1), 85-93.

Lee, M. C. (2009). Factors influencing the adoption of internet banking: An integration of TAM and TPB with perceived risk and perceived benefit. *Electronic commerce research and applications*, *8*(3), 130-141.

Lim, S. H., Kim, D. J., Hur, Y., & Park, K. (2019). An Empirical Study of the Impacts of Perceived Security and Knowledge on Continuous Intention to Use Mobile Fintech Payment Services. *International Journal of Human–Computer Interaction*, *35*(10), 886-898.

Marakarkandy, B., Yajnik, N., & Dasgupta, C. (2017). Enabling internet banking adoption. *Journal of Enterprise Information Management*.

Masoud, E., & AbuTaqa, H. (2017). Factors affecting customers' adoption of e-banking services in Jordan. *Information Resources Management Journal (IRMJ)*, *30*(2), 44-60.

Nayanajith, G., & Damunupola, K. A. (2019a). Effects of Subjective Norms and Security on Online Banking Adoption: Multilevel Linear Model Analysis. *Asian Journal of Multidisciplinary Studies*, *2*(1).

Nayanajith, G., & Damunupola, K. A. (2019b). Relationship of Perceived Behavioral Control and Adoption of Internet Banking in the Presence of a Moderator. *Asian Journal of Multidisciplinary Studies*, *2*(2).

Nayanajith, G., Damunupola, K. A., & Ventayen, R. J. (2019a). User Intentions and Actions Towards Adoption of Technology Based Self-Service Banking Services: A MANOVA Analysis. *Southeast Asian Journal of Science and Technology*, *4*(1).

Nayanajith, G., Damunupola, K. A., & Ventayen, R. J. (2019b). Relationship of Perceived Trust and Perceived Ease of Use on Adoption of Computer Aided Learning in the Context of Sri Lankan International Schools. *Southeast Asian Journal of Science and Technology*, *4*(1).

Nayanajith, G., Damunupola, K. A., & Ventayen, R. J. (2019c). Impact of Innovation and Perceived Ease of Use on E-Learning Adoption. *Asian Journal of Business and Technology*, *2*(1).

Nayanajith, G., Damunupola, K. A., & Ventayen, R. J. (2019d). Website Usability, Perceived Usefulness and Adoption of Internet Banking Services in the Context of Sri Lankan Financial Sector. *Asian Journal of Business and Technology*, *2*(1).

Nayanajith, G., Damunupola, K. A., & Ventayen, R. J. M. (2019e). Online Banking Transactions and Mere-Exposure Effect. *Online Journal of Technology Innovation*, *2*.

Nayanajith, G., Damunupola, K. A., & Pastor, C. K. (2020). Telebanking Adoption Intentions, Actions and Subjective Norms in the Context of Sri Lankan Private Commercial Banks. *Southeast Asian Journal of Science and Technology*, *5*(1).

Nor, K. M., & Pearson, J. M. (2015). The influence of trust on internet banking acceptance. The Journal of Internet Banking and Commerce, 2007.

Perera, K. M. M. K. (2013). *Factors Affecting Usage of Internet Banking in Sri Lanka: The Case of Local Private Commercial Banks in Colombo District* (Doctoral dissertation, University of Sri Jayewardenepura, Nugegoda).

Pikkarainen, T., Pikkarainen, K., Karjaluoto, H., & Pahnila, S. (2004). Consumer acceptance of online banking: an extension of the technology acceptance model. *Internet Research*, *14*(3), 224-235.

Poon, W. C. (2008). Users' adoption of e-banking services: the Malaysian perspective. *Journal of Business & Industrial Marketing*.

Priyangika, R. D., Perera, M. S. S., & Rajapakshe, D. P. (2016). An Empirical Investigation on Customer Attitude and Intention towards Internet Banking: A Case of Licensed Commercial Banks in Colombo District, Sri Lanka.

Rahi, S. (2015). Moderating role of brand image with relation to internet banking and customer loyalty: a case of branchless banking. *The Journal of Internet Banking and Commerce*, 20(3).

Rahi, S., & Ghani, M. A. (2018). The role of UTAUT, DOI, perceived technology security and game elements in internet banking adoption. *World Journal of Science, Technology and Sustainable Development*.

Rajapakse, R. P. C. R. (2017). E-Banking: A Review of Status, Implementation, Challenges and Opportunities.

Rakesh, H. M., & Ramya, T. J. (2014). A study on factors influencing consumer adoption of internet banking in India. *International Journal of Business and General Management*, *3*(1).

Rawashdeh, A. (2015). Factors affecting adoption of internet banking in Jordan. International Journal of Bank Marketing.

Samar Rahi, Mazuri Abd. Ghani, (2018) "The role of UTAUT, DOI, perceived technology security and game elements in internet banking adoption", World Journal of Science, Technology and Sustainable Development, Vol. 15 Issue: 4, pp.338-356, https://doi.org/10.1108/WJSTSD-05-2018-0040

Sampath Bank PLC, 2019. *Annual Report, 2018*.

Sanayei, A., & Bahmani, E. (2012). Integrating TAM and TPB with perceived risk to measure customers' acceptance of internet banking. *International Journal of Information science and management (IJISM)*, 25-37.

Saunders, M. N. (2011). *Research methods for business students, 5/e*. Pearson Education India.

Shareef, M. A., Kumar, V., Kumar, U., & Dwivedi, Y. K. (2011). e-Government Adoption Model (GAM): Differing service maturity levels. *Government information quarterly*, *28*(1), 17-35.

Sheppard, B. H., Hartwick, J., & Warshaw, P. R. (1988). The theory of reasoned action: A meta-analysis of past research with recommendations for modifications and future research. *Journal of consumer research*, *15*(3), 325-343.

Slade, E. L., Dwivedi, Y. K., Piercy, N. C., & Williams, M. D. (2015). Modeling consumers' adoption intentions of remote mobile payments in the United Kingdom: extending UTAUT with innovativeness, risk, and trust. *Psychology & Marketing*, *32*(8), 860-873.

Suh, B., & Han, I. (2002). Effect of trust on customer acceptance of Internet banking. *Electronic Commerce research and applications*, *1*(3-4), 247-263.

Suh, B., Han, I., 2003. The impact of customer trust and perception of security control on the acceptance of electronic commerce. Int. J. Electron. Commerce 7

Taherdoost, H., Sahibuddin, S., & Jalaliyoon, N. (2011). Smart card security; Technology and adoption. *International Journal of Security*, *5*(2), 74-84.

Vatanasombut, B., Igbaria, M., Stylianou, A. C., & Rodgers, W. (2008). Information systems continuance intention of web-

based applications customers: The case of online banking. *Information & Management*, *45*(7), 419-428.

Venkatesh, V. (2000). Determinants of perceived ease of use: Integrating control, intrinsic motivation, and emotion into the technology acceptance model. *Information systems research*, *11*(4), 342-365.

Wai-Ching Poon, (2007) "Users' adoption of e-banking services: the Malaysian perspective", Journal of Business & Industrial Marketing, Vol. 23 Issue: 1, pp.59-69, https://doi.org/10.1108/08858620810841498

Weippl, E. R. (2005). In-depth tutorials: Security in e-learning. *eLearn Magazine*, *2005*(3), 3.

Zeithaml, V. A., Parasuraman, A., & Malhotra, A. (2000). *A conceptual framework for understanding e-service quality: implications for future research and managerial practice*. Marketing Science Institute.

ISSN 2738-2028 (Online) | Vol. 4 | No. 1 & 2 | 2020 January & July

JBT

Journal of Business and Technology

International peer-reviewed journal | Publish semi-annually

The Mediating Effect of Innovation Capability Towards Export Performance of Small and Medium Enterprises in Sri Lanka

J. Galagedara[1]* and S. M. A. K. Samarakoon [2]

[1] Faculty of Graduate Studies, University of Kelaniya, Sri Lanka.
[2]Department of Commerce and Financial Management, University of Kelaniya, Sri Lanka.
* Corresponding author: jayanigalagedara@gmail.com

Abstract

Export is one of the most important factors influencing economic growth. As a developing country, a systematic action plan is needed to expand the export sector because Sri Lanka's economy is largely dependent on international trade. Small and Medium-Sized Enterprises (SMEs) play a vital role to develop the export performance of a country. entrepreneurial orientation and innovation capabilities are important factors that directly affected on internationalization of SMEs. There is no research done in the past to identify the mediating effect of innovation capability on the relationship between entrepreneurial orientation and export performance. Accordingly, this study intended to fill the gap by testing the mediating effect of innovation capability on the relationship between entrepreneurial orientation and export performance. In this context, the objective of this research is to examine the mediating effect of Innovation capabilities on the relationship between entrepreneurial orientation and export performance of SMEs in Sri Lanka. This study followed a quantitative research design to examine the above relationship by using the processing technique. The examined population in this research are the exporters who have export turnover below Rs. 150 Mn. Data is collected through a structured questionnaire distributed among 200 exporters. Both descriptive and inferential statistical techniques were used to analyze the collected data using SPSS. The study found that innovation capability has a partial mediation effect on the relationship between entrepreneurial orientation and export performance. Accordingly, SMEs should improve the level of entrepreneurial orientation and, innovation capability to improve the export performance of SMEs.

Keywords: *Entrepreneurial Orientation, Innovation Capability, Export Performance, Small and Medium Entrepreneurs, Internationalization.*

Introduction

Small and Medium Enterprises (SMEs) have been recognized as the backbone of an economy (Arinaitwe 2006). Moreover, a significant role played by the SMEs in the economy who are spread worldwide (Philip 2010, Islam at al 2011). They contribute to the economy through providing employment opportunities, reducing income disparities developing skilled and semi-skilled workers, improving entrepreneurial and managerial talent, increasing the balance of payment surplus, and stimulating other economic activities (Kazem and Heijden 2006). At present, globalization is very crucial to the growth of the business. Therefore, SMEs are considered as a strategic tool for the expansion of exports. Past researchers also have explained that internationalization provides benefits for SMEs including better survival prospects (Lee et al., 2012), increased revenue and growth (USITC, 2010), better innovative capability, and improved productivity (Kalinic & Forza, 2012) compared to non-internationalized SMEs. It is

accepted that internationalization is useful for organizations and that helps to obtain better performance and growth.

At present SMEs are actively participated in export activities in most countries and SME contribution to the export sector lies between 30 percent to 50 percent (Wijayarathne and Perera 2018). Nonetheless, in the Sri Lankan context, SME contribution to the export sector is around 4 percent. Accordingly, the SME contribution to total exports is very low. As mentioned by the various researches, the export barriers badly affected the export activities of the SMEs (Jalali (2012) and Ortega (2003). SME exports of Sri Lanka highly depend on few exporting regions and industry sectors. Sri Lankan SME exports consist of primary goods and they use technologically stagnant production practices that could be copied by competitors easily (Kelegama, 2013).

Some researchers have argued that SMEs face difficulties to enter into the international market such as shortage of capital, inadequate infrastructure, absence of innovation, lack of market information, competition, obsolete technology, and lack of labor skills and managerial skill (Yoshino and Hesary, T. (2016). Entrepreneurial orientation has become an important element in internationalization. Therefore, it supports identifying entrepreneurial qualities, find out exploit untapped market opportunities; enhance the capabilities of the respondent of challenges, improve the ability to take risks in the business, identify the opportunities and improve the ability to compete with other established organizations (Wiklund & Shepherd 2005). Therefore, the level of entrepreneurial orientation is an important element to determine the success of their globalization. (Lan Q., & Wu S., 2009). In recent years, SMEs tend to use entrepreneurship principles and adopt innovative approaches to enter the international market. Further, entrepreneurial orientation also helps to increase the export performance of a country and it might encourage entrepreneurs to enter into the export market (Okpara J.O., 2009). On the other hand, Innovation capability also plays a major role to improve SMEs performance (Filipescu et al.,2013) and It helps to improve the technology and product quality of the organization.

The majority of studies focus on the impact of entrepreneurial orientation and innovation capabilities on firm performance. However, limited research was conducted to find out the indirect effect of entrepreneurial orientation on the business performance in SMEs. Some research studies were conducted base on developed countries but it is difficult to find out studies base on SMEs in developing countries. Accordingly, it is very important to conduct a study to fill the gap by testing the mediating effect of innovation capability on the relationship between entrepreneurial orientation and export performance of the SME sector in Sri Lanka. There are three key objectives of this study; (1) to examining the effect of entrepreneurial orientation and innovation capability on export performance (2) to examine the direct effect of entrepreneurial orientation on innovation capability and (3) to measure the mediating effect of innovation capability on the relationship between entrepreneurial orientation and export performance.

Conceptual Framework and Hypotheses

Basically, the model has been divided into three stages. Stage one of the model depicts the influence of entrepreneurial orientation on the export performance of SMEs in Sri Lanka. This study has identified five dimensions of Entrepreneurial Orientation such as innovativeness, proactiveness, risk-taking, competitive aggressiveness, and autonomy. Stage two depicts the influence of innovation capability on export performance and entrepreneurial orientation effect on innovation capabilities. The final stage depicts the influence of the mediating effect of innovation capabilities on the relationship between entrepreneurial orientation and export performance.

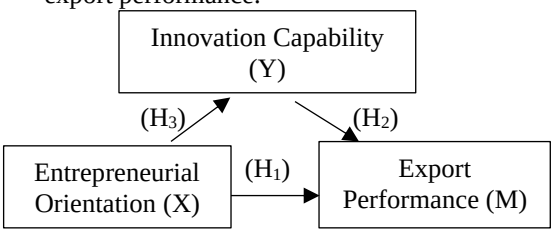


Figure 01: Conceptual Framework of the study

Entrepreneurial Orientation and Export Performance

Several efforts have been taken to identify the impact of entrepreneurial orientation on the export performance of firms in various countries and most of the researches have explained that a strong relationship can be seen in the improvement of export performance in a firm. (Wiklund, 1999; Zahra and Garvis 2000; Lumpkin and Dess 2001). Accordingly, Zahra et al. (2000) explained that entrepreneurial activities help to enhance market opportunities to reach the international market. Many researchers have identified a positive relationship between EO and export performance (Rauch, Wiklund, Limpkin, & Frese, 2009). But, few studies have explained the negative relationship between entrepreneurial orientation and export performance (George, Wood, & Khan, 2001).

H_1- Entrepreneurial Orientation positively influences on export performance of SMEs in Sri Lanka.

Innovation Capability and Export Performance

Several types of research have explained that innovation can influence the firm's export performance both positively and negatively. Accordingly, Ussahawanitchakit (2007) explained that firms who are engaged in export business have exploited that how innovative capabilities influence to increase the export performance. Aranda et al. (2001) argued that innovation is one of the most core value creation activities and a competitive weapon for firms who are engaged in the export business. That can be helped to firms to create new ideas to develop products, services, and processes to enable them to increase performance and attain a competitive edge (Jantunen, 2005). Mohammod, Massie, and Tumewu (2019) recently examined the effect of innovation capability on a firm's performance and found that innovation capability has a positive effect on a firm's performance in SME's in Manado.

H_2- Innovation capabilities positively influence on export performance of SMEs in Sri Lanka.

Mediating Effect of Innovation Capability

As explained by Guan, Ma (2003); Zahra et al. (2006) Innovation capabilities play a vital role to improve product development capacity and develop managerial skills and production processes. Innovative capabilities are recognized as a major tool with a high level of proactivity, risk-taking, and innovation and that could enable SMEs to develop and innovate new products and markets and that could be helped to improve their level of entrepreneurism (Preda, 2013). Rauch, Wiklund, Lumpkin, and Frese (2009) explained that entrepreneurial orientation can be recognized as a strategic process of decision-making that assists SMEs by creating competitive advantages including innovation. Therefore, innovation can be considered an important activity and can be used for the development of new products, processes, and management systems (Lumpkin & Dess, 1996; Wiklund & Shepherd, 2005). Meliá et al. (2010) explained that innovative firms can transform their resources and processes and structures to enter into new international markets. Filipescu et al. (2013) explained that innovation and exports have a mutual relationship. Accordingly, innovative firms can be able to enter into foreign markets easily. As explained by Posner (1961), the continuity of exports of a country depends on the usage of new technology for their production processes. Innovation activities are the most important elements in determining a firm's strategic decision related to export activities (Cassiman, Golovko, & Martínez-Ros, 2010).

H_3 Entrepreneurial Orientation positively influences on the innovation capacity of SMEs.

H_4 Innovation capabilities mediating the relationship between Entrepreneurial Orientation and export performance of SMEs in Sri Lanka.

Research Methodology

Population, Sample and Sampling Method

The population of this study consists of exporters in Sri Lanka with an export turnover of less than Rs.150 Mn. The exporters who have export turn over less than Rs. 150 Mn.

considered as SME exporter by the EDB. The target group was identified through the custom database available at the Sri Lanka Export Development Board (EDB). EDB maintains a database for exporters and it represents 3940 exporters. Table 01 shows the exporters available in the database maintained by the EDB.

Table 01: Number of Exporters by Export Turnover 2018

Item	No of exporters	Export Value - 2018 US$ - Mn.	Percentage %
Total	3940	11,890	
Turn Over below Rs.150 Mn.	3095	451	4%
Turn Over above Rs.150 Mn.	845	11,439	96%

Source: database - Sri Lanka export development board

The study population was limited to SME exporters with an export turnover of less than Rs.150 Mn. per annual and it consists of 3095 exporters in Sri Lanka. Most research studies mentioned that it is difficult to collect data from the whole population due to practical difficulties such as money, time, and transport. Therefore, it is needed to select a representative sample to generalize the conclusions on the population with reasonable confidence (Singh, 2007).

Since it is difficult to study this entire population, this study has selected 200 SME exporters as a sample. The sample size was determined under the confidence level of 99% and a margin of error of 3 percent based on the operational population (Bartlett, Kotrlik, and Higgins, 2001). The stratified proportional random sampling method was used to select the required sample for this study since it is the most appropriate sampling method. Exporters (T/O below Rs. 150 Mn.) covering all product sectors were identified separately and the number of SMEs were selected randomly using a simple random table stated in 02.

Table 02: Distribution of the Sample

Product Sectors	Population (No of Exporters)	Percentage out of total no. of SMEs	Required no. of SMEs for the sample
Apparel	337	10	33
Spices &Allied Products	244	10	24
Fish &Fisheries	196	5	10
Rubber Product	131	10	13
Coconut &Coconut based products	327	5	16
Floriculture	152	2	7
Foods & Beverages	241	5	12
Ornamental Fish	59	2	1
Gem &Jewellery	227	7	16
Fruit &Vegetables	348	5	17
Ceramic &Porcelain	220	5	11
Wooden Products	195	2	3
Footwear &Leather products	175	5	8
Ship &Boat Building	16	10	1
Electronic Products	228	10	22
Light Engineering	337	2	6
Total	3095		200

The data was gathered through a questionnaire to examine the influence of the moderating effect of innovation capability on the relationship between entrepreneurial orientation and export performance.

Measurement of Variables

Entrepreneurial Orientation and Innovation Capabilities

The main independent variable is entrepreneurial orientation and the majority of studies have used three dimensions of entrepreneurial orientation i.e. innovativeness, pro-activeness, and risk-taking. However, this study focused on five dimensions including another two dimensions i.e. competitive aggressiveness and autonomy. The relevant indicators were adopted from Venter, A (2014); George & Helen (2007), and Abdullahi, Kunya, Bustani & Usman (2019). Innovation capabilities of SMEs were adopted from Gurhan, Gunduz, Kemal & Lutfihak (2011), and both variables were measured through 5-point scale statements ranging from "strongly agree" to "strongly disagree. Aranda et al. (2001) argued that innovation is one of the most core value creation activities and a competitive weapon for firms who are engaged in the export business. Mohammod, Massie & Tumewu (2019) recently examined the effect of innovation capability on a firm's performance and found that innovation capability has a positive effect and significance on a firm's performance in SMEs in Manado. Filipescu et al. (2013) explained that innovation and exports have a mutual relationship.

Export Performance

The performance of the firm was measured using financial and non-financial measurements includes the sales growth of export, the sales volume of export, profit contribution of export, and Satisfaction with export operations. The export variable measurement was adopted from Godwin, Joseph & Muhammed (2013). Most organizations do not maintain financial reports properly and they reluctant to disclose financial data to the third party. Therefore, owners/managers were asked questions to identify the trend of the indicators during the last three years. These indicators were measured through a five-point liker scale indicating "highly increased" "increased", "moderate", "decreased" and "highly decreased".

Findings and Discussion

Table 03 shows the summary of the reliability test for the independent variables (entrepreneurial orientation and innovation capability) and dependent variable (export performance).

Table 03: Reliability Test results

Construct	**Cronbach's Alpha**	**Number of Items**
Entrepreneurial Orientation	.807	25
Innovation Capabilities	.917	6
Export Performance	.857	4

According to table 03, the Cronbach's Alpha value of the three variables is higher than the accepted level.

Descriptive Analysis of respondents

Table 04 shows age, gender, marital status, level of education, and prior business experience before entering into the business.

Table 04: Characteristics of the sample

Characteristics		Total	Percentage
Age of the Owner/manager	20-30 Years	18	13
	31-40 Years	33	23
	41-50 Years	37	26
	51-60 Years	42	29
	61-70 Years	11	8
	More than 70 years	2	1
	Total	**143**	**100**
Gender	Female	10	7
	Male	133	93
	Total	**143**	**100**
Marital Status of the	Single	14	10

respondents			
	Married	129	90
	Total	**143**	**100**
Educational qualification of respondents	Below GCE (O/L)	4	3
	GCE (O/L)	7	5
	GCE (A/L)	30	21
	Certificate/Diploma	32	22
	Professional Qualification	24	17
	Graduate	38	26
	Post Graduate	8	6
	Total	**143**	**100**
Prior Business Experience	Yes	91	64
	No	52	36
	Total	**143**	**100**

As shown in table 04, the majority of respondents are in the age category of 51-60 years which is 29 percent and according to the above table, a total of 133 respondents (93%) in this study are men while only 10 (7%) are women. Further, as mentioned in the above 90 percent of them are married and 10 percent of them are single and the majority of them are having a degree which is 26 percent of total respondents. According to the above table, 64 percent of them are having the prior business experience to enter into international business.

The profile characteristics of SMEs

The profile characteristics consist of age of the business, legal form of the firm, export turnover of the firm, total No. of employees, whether the business is a family business or not, and the nature of the business. The following table shows the descriptive analysis of the profile characteristics of SME owners/managers.

Table 05: The profile characteristics of SMEs

Characteristics		Total	Percentage
Age of the business	Less than 5 Years	25	17
	5-10 years	36	25
	11-15 years	33	23
	16-20 years	26	18
	More than 20 years	23	16
	Total	**143**	**100**
Legal Status of the company	Proprietorship	26	18
	Partnership	46	32
	Private Limited Company	71	50
	Total	**143**	**100**
Annual Turn Over of the companies	Less than 25 Mn.	43	30
	25 Mn. - 50 Mn.	49	35
	50 Mn. - 100 Mn.	26	18
	100 Mn. - 150 Mn.	25	17
	Total	**143**	**100**
Number of employees of the organizations	10-50 employees	40	28
	51-100 employees	53	37
	101-200 employees	36	25
	201-300 employees	14	10
	Total	**143**	**100**
Whether Business is a family business	Yes	88	62
	No	55	38

	Total	143	100
Nature of the Business	Only to Export Market	80	56
	Both Export and Local Market	63	44
	Total	**143**	**100**

As indicated in table 05, the age distribution of the firm is concerned, the majority of SMEs prevail in their business from 5 to 10 years and 50 percent of SMEs have private limited companies. Further, the Majority of respondents are having export turn over 25 Mn- 50 Mn. which is 35 percent of the total respondents and 37 percent of SMEs are having 51-100 employees. The above table depicts that 62 percent of SMEs are from family businesses while 38 percent of SMEs are not having a family business background and also the above table shows 56 percent of SMEs are supplying their products only to the export market.44 percent of SMEs are supplying their production both export and local market.

The following table 06 displays the summary of the measured constructs of entrepreneurial orientation, innovation capability.

Table 06: Entrepreneurial orientation and Innovation capability levels

	N	Minimum	Maximum	Mean	Std. Deviation
Entrepreneurial Orientation	143	2.96	4.36	3.6604	.27854
Innovation Capabilities	143	2.00	4.83	3.4149	.61599
Valid N (listwise)	143				

As depicts in table 06, the mean value of entrepreneurial orientation is 3.66, and the mean value of innovation capability is 3.41. The standard deviation of entrepreneurial orientation and innovation capability is 0.28 and 0.61 respectively. Accordingly, the above summary depicts the mean values of all the variables with acceptable standard deviations ($s < 0.8$). Therefore, the values can be considered acceptable for this study.

This study examined the influence of each dimension of entrepreneurial orientation (innovativeness, Autonomy, Risk Taking, Competitive Aggressiveness & Pro-activeness) on the export performance of SMEs. It's R Square value is 0.311 (Adjusted R square 0.285). Table number 07 shows the result of multiple regression analysis of each dimension of entrepreneurial orientation and export performance.

Table 7: Multiple Regression Analysis Result – each Dimension of Entrepreneurial Orientation and Export Performance.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.623	.542		-1.149	.252
	Innovativeness	.332	.101	.265	3.305	.001
	Proactiveness	.237	.121	.158	1.964	.052
	Risk-taking	.162	.121	.115	1.344	.181
	Cog_Aggress	.051	.106	.038	.483	.630
	Autonomy	.282	.132	.196	2.135	.035

Dependent Variable: Export Performance

The results of table 07 shows that innovativeness and autonomy has a significant impact on ($p<0.05$), export performance. However, pro-activeness, risk-taking and Competitive Aggressiveness didn't show a significant impact on export performance.

The mediating effect of innovation capabilities on the relationship between entrepreneurial orientation and export performance was examined using the Process technique proposed by Hayes, A.F. (2013) which is widely used.

Table 08 shows the results of the mediating effect test showing both the direct and indirect effect of the entrepreneurial orientation on the export performance.

Table 08 - Model Summary of mediating effect

Model	R	R Square	MSE	F	df1	df 2	P
	.4346	.1889	.3100	32.8307	1.0000	141.0000	.0000

Table 09: Direct and indirect effect of innovation capability on the relationship between entrepreneurial orientation and export performance.

		Coefficients	Se	t	p	LLCI	ULCI	Standardized coefficients
	(Constant)	-.1031	.6157	-.1674	.8673	-1.3203	1.1142	
	Entrepreneurial_ Orientation	.9611	.1677	5.7298	.0000	.6295	1.2927	.4346

The direct effect of entrepreneurial orientation on export performance

Effect	Se	t	p	LLCI	ULCI	c'_ps	c'_cs
.6576	.1356	4.8487	.0000	.3895	.9258	1.1761	.3276

Indirect effect(s) of entrepreneurial orientation on export performance

	Effect	BootSE	BootLLCI	BootULCI
Innovation	.4239	.0939	.2562	.6196

Partially standardized indirect effect(s) of entrepreneurial orientation on export performance

	Effect	BootSE	BootLLCI	BootULCI
Innovation	.7580	.1460	.4879	1.0585

Completely standardized indirect effect(s) of entrepreneurial orientation on export performance

	Effect	BootSE	BootLLCI	BootULCI
Innovation	.2111	.0420	.1321	.2972

The results in table 9 support the mediation effect hypothesis as it can be observed from the results that the bootstrap 95% confidence interval does not include zero. Therefore, innovation capabilities mediate the relationship between entrepreneurial orientation and export performance.

Conclusion

As indicated in this study the majority of entrepreneurs/managers fall in the age group of 51-60 years and the majority of with 65.12% of entrepreneurs and managers being men. Further, an entrepreneur should have sufficient knowledge and educational qualifications to survive in the export market. Respondents have sufficient education qualifications (38 of the respondent are graduated). Most of them have prior experience in the export market and it is an important criterion to enter into the export market. According to the analysis of the study, 25 percent of businesses had an

operational export experience of 5 -10 years. Further, the majority of export companies have good experience in the local market and the international market as well. i.e. most companies are well-established companies in the local market and 35 percent of SMEs have reported an annual export turnover of Rs.25 Mn. Rs. 50 Mn. It was found that most businesses operated in the sectors such as food and beverages, ornamental fish, coconut and coconut-based products, wooden products and footwear products, etc. Those sectoral contributions to the export sector are very low. As depicts in table 4.9, 37 percent of SMEs have employees 51- 100 nos. and 28 percent of SMEs have employees 10 – 50 nos. As mentioned in table 4.10, 62 percent of SMEs are family businesses.

This study revealed that there is a positive impact of entrepreneurial orientation on the export performance of SMEs. Further, the researcher analyzed the effect of each dimension of entrepreneurial orientation on export performance and It is revealed that only innovativeness and autonomy positively influence on export performance of SMEs. Moreover, Atuahene-Gima & Ko, (2001) also mentioned that Entrepreneurial orientation allows SMEs to improve their abilities and creativity that produce higher possibilities to increase the level of innovation and competitive advantages. Since it is very important to improve the level of entrepreneurship within the SEMs to improve SMEs' export performance level. Further, SME owners advance the level of innovativeness and autonomy because of these two factors more significant than another dimension of Entrepreneurial orientation. On the other hand, the study result revealed the direct effect of entrepreneurial orientation and innovation capabilities on export performance. Moreover, the relationship between entrepreneurial orientation and export performance is mediated by innovation capabilities.

Recommendations

Among the dimensions of entrepreneurial orientation, innovativeness and autonomy provide better results in order to increase export performance. Since entrepreneurs and managers are encouraged to improve their education level and improve their knowledge about the business environment to improve the success of SMEs. Moreover, the owner/manager of SMEs should be more innovative in their business activities. Therefore, the training programs and workshops should be designed to improve the innovation capability of owners/managers and employees of the organization and also recommended to change the education system of the country. In addition to that policy, the decision can be made regarding the development of an SME sector in Sri Lanka and develop them to enter into the international market as their contribution to the export sector is very low. Since the researcher suggests designing training programs for entrepreneurs to educate on the international market and design financial assistance programs to encourage SMEs internationalization, etc.

Limitations and Suggestions for Future Research

This study considered only exporters who are engaging in exporting tangible products but service exporters are not covered through this research. Since future researchers can conduct the same research covering both manufacturing and service-related SMEs. In this study, the sample has been selected from the database maintained by the Sri Lanka Export Development Board and it contains 3095 SME exporters with export turnover below Rs. 150 Mn. This study has used 200 SMEs as the sample out of 3095 SMEs where the sample represents a population of 6.4% only. If the sample size was bigger than the used sample size the results may be changed. Moreover, the Researcher suggests doing the same research considering various product sectors of export including a great sample of exporters. This study SME was defined based on export turnover criteria but then again conduct the same research using additional criteria to define export SMEs and export performance. In this study, there are only two independent variables (entrepreneurial orientation and innovation capability) used to measure the impact on export performance. For further researchers could use variables such as entrepreneurial intention,

entrepreneurship education & attitudes towards behavior.

References

Abdullahi, U., Kunya, S. U., Bustani, S. A., & Usman, N. (2019). Impact of Competitive Aggressiveness on Performance of Small and Medium Construction Firms in Nigeria. *FUTY Journal of the Environment*, *13*(1), 65-74.

Ahimbisibwe, G. M., Ntayi, J. M., & Ngoma, M. (2013). Export Market Orientation, innovation and performance of fruit exporting firms in Uganda. *European Scientific Journal*, *9*(4).

Arinaitwe, J. K. (2006). Factors constraining the growth and survival of small-scale businesses. A developing countries analysis. *Journal of American Academy of Business, Cambridge*, *8*(2), 167-178.

Atuahene-Gima, K., & Ko, A. (2001). An empirical investigation of the effect or market orientation and entrepreneurship orientation alignment on product innovation, *Organization Science*, 12(1), 54-74.

Arias-Aranda, D., Minguela-Rata, B., & Rodríguez-Duarte, A. (2001). Innovation and firm size: an empirical study for Spanish engineering consulting companies. *European Journal of Innovation Management*.

Bartlett, J.E. , Kotrlik, J.W. and Higgins, C.C. (2001) Determining Appropriate Sample Size in Survey Reserch. *Information Technology, Learning and Performance Journal.* 19 (1), 43-50

Cassiman, B., Golovko, E., & Martínez-Ros, E. (2010). Innovation, exports and productivity. *International Journal of Industrial Organization*, *28*(4), 372-376.

Filipescu, D., Prashantham, S., Rialp, A., Rialp, J. (2013). Technological innovation and exports: unpacking their reciprocal causality, *Journal of International Marketing* 21(1): 23–38. https://doi.org/10.1509/jim.12.0099

George, J. A., & Helen, E S. (2007). Entrepreneurial Orientation of SMEs, Product innovativeness and Performance, *Journal of Business Research* 60 (2007), 566-575.

George, G., Robley Wood Jr, D., & Khan, R. (2001). Networking strategy of boards: Implications for small and medium-sized enterprises. *Entrepreneurship & Regional Development*, *13*(3), 269-285.

Guan, J., & Ma, N. (2003). Innovative capability and export performance of Chinese firms. *Technovation*, *23*(9), 737-747.

Gurhan, G., Gunduz, U., Kemal, K., & Lutfihak, A. (2011). Effect of Innovation Types on Firm Performance, Published in *International Journal of Production Economics*, 133, 662-676.

Hayes, A. F. (2017). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. Guilford publications.

Islam, M. A., Khan, M. A., Obaidullah, A. Z. M., & Alam, M. S. (2011). Effect of entrepreneur and firm characteristics on the business success of small and medium enterprises (SMEs) in Bangladesh. *International Journal of Business and Management*, *6*(3), 289.

Jalali S.H., (2012), Export Barriers and Export Performance; Empirical Evidence from the commercial relationship between Greece and Iran, *South-Eastern Europe Journal of Economics*, 1 (2012) 53-66

Jantunen, A. (2005). Knowledge-processing capabilities and innovative performance: an empirical study. *European Journal of Innovation Management*.

Kelegama, S. (2013). Export Sector in Sri Lanka: Issues and Challenges. *Proceedings of 18th AGM of National Chamber of Exporters*.

Kazem, A., & van der Heijden, B. (2006). Exporting Firms' Strategic Choices: The

Case of Egyptian SMEs in the Food Industry", *SAM Advanced Management Journal*, 71(3), 21-33.

Kalinic, I., & Forza, C. (2012). Rapid internationalization of traditional SMEs: Between gradualist models and born globals. *International Business Review*, *21*(4), 694-707.

Lumpkin, G.T., & Dess, G.G., (2001). Linking two dimensions of entrepreneurial orientation to firm performance: The moderating role of environment and industry life cycle, *Journal of Business Venturing*, 19(5) 429- 451.

Lumpkin, G. T., & Dess, G. G. (1996). Clarifying the entrepreneurial orientation construct and linking it to performance. *Academy of management Review*, *21*(1), 135-172.

Lan, Q., & Wu, S., (2009), An empirical study of entrepreneurial orientation and degree of internationalization of small and medium-sized Chinese manufacturing enterprises, *Journal of Chinese Entrepreneurship*, 2 (1)

Lee, H., Kelley, D., Lee, J., Lee, S., & Lee, A. (2012). SME Survival: The Impact of Internationalization, Technology. *Journal of Small Business Management*, 50(1), 1–19.

Mohammad, I. N., Massie, J. D., & Tumewu, F. J. (2018). The effect of entrepreneurial orientation and innovation capability towards firm performance in small and medium enterprises (Case Study: Grilled Restaurants in Manado). *Jurnal EMBA: Jurnal Riset Ekonomi, Manajemen, Bisnis dan Akuntansi*, *7*(1).

Meliá, M.; Pérez, A.; Dobón, S. 2010. The influence of innovation orientation on the internationalization of SMEs in the service sector, *The Service Industries Journal* 30(5): 777–791. https://doi.org/10.1080/02642060802342679

Okpara, J. O. (2009), The entrepreneurial export orientation and performance of small firms in a developing economy, *International Journal of Globalization and Small Business*, 3 (3).

Ortego S.S., (2003), Export Barriers: Insights from Small and Medium-Sized Firms, *International Small Business Journal*, 21(4): 403–419

Preda, G. (2013). The influence of entrepreneurial orientation and market-based organizational learning on the firm's strategic innovation capability. *Management & Marketing*, *8*(4).

Posner, M. V. (1961). International trade and technical change. Oxford Economic Papers, 13(3), 323-341.

Philip**,** M., (2010), Factors affecting business success of small & medium enterprises (SMEs), *Asia Pacific Journal of Research in Business Management*, 1(2).

Rauch, A., Wiklund, J., Lumpkin, G. T., & Frese, M. (2009). Entrepreneurial orientation and business performance: An assessment of past research and suggestions for the future. *Entrepreneurship theory and practice*, *33*(3), 761-787.

Singh, K. (2007). Research process. *Quantiative social research methods. Sage Publication India Pvt Ltd*, 75-6.

Ussahawanitchakit, P. (2007). innovation capability and export performance: an empirical study of textile businesses in thailand. *Journal of International Business Strategy*, *7*(1).

Schmidtlein, R. K., Johanson, C. D. S., Williamson, I. A., Broadbent, M. M., & Kieff, F. S. (2014). United States International Trade Commission.

Venter, A. (2014). *An analysis of the influence of entrepreneurial orientation on business success in selected small and medium–sized enterprises* (Doctoral dissertation).

Wiklund, J. (1999). The sustainability of the entrepreneurial orientation—performance relationship. *Entrepreneurship theory and practice*, *24*(1), 37-48.

Wiklund, J., & Shepherd, D. (2005). Entrepreneurial orientation and small business performance: a configurational approach. *Journal of business venturing*, *20*(1), 71-91.

Wijayarathne, J. M. D. S., & Perera, M. P. S. R., (2018), Sri Lankan SMEs and Perceived Export Barriers: Evidence from Manufacturing Sector, *Asian Journal of Economics, Business and Accounting*, 7 (3), 1-10.

Yoshino, N., & Taghizadeh Hesary, F. (2016). Major challenges facing small and medium-sized enterprises in Asia and solutions for mitigating them.

Zahra, S. A., & Garvis, D. M. (2000). International corporate entrepreneurship and firm performance: The moderating effect of international environmental hostility. *Journal of business venturing*, *15*(5-6), 469-492.

Zahra, S. A., Sapienza, H. J., & Davidsson, P. (2006). Entrepreneurship and dynamic capabilities: A review, model and research agenda. *Journal of Management studies*, *43*(4), 917-955.

JBT

Journal of Business and Technology

International peer-reviewed journal | Publish semi-annually

Impact of Labor Costs and Investment in Human Capital on Financial Performance: Evidence from Listed Companies in Sri Lanka

W. N. R. A. Kantha[1*] and S. S. Weligamage[2]

[1 2] Faculty of Commerce and Management Studies, University of Kelaniya, Sri Lanka.
[*] Corresponding author: kantha.nra@gmail.com

Abstract

The wealth of a company depends on physical assets and intangible assets. The objective of this study is to identify the impact of labor costs and investment in human capital on the financial performance of listed companies in Sri Lanka. The study is based on secondary data and collected from published annual reports of the selected listed companies in Sri Lanka over the period of 2014 and 2018. The sample consists of fifty-nine (59) companies selected using stratified sampling covering both high and low market capitalization companies in each sector for a period of five (05) years. Labor cost, Investment in human Capital, Return on Assets (ROA) and Earning per share are the variables included in the study. Findings proved that there is a significant positive impact of average Labor Cost on ROA and there is a weak positive correlation between earning per share and average labour cost. Companies with high market capitalization show a moderate positive correlation and companies with low market capitalization are not statistically significant. This study concluded that labour cost and investment in human capital have a positive impact on the financial performance of Sri Lankan listed companies and this relationship is varied based on market capitalization. So, the efforts taken by companies to improve human capital is encouraging and those may directly influence the value creation process of an organization.

Keywords: *Human capital, Intangible assets, Investment, Labor cost*

Introduction

Companies earn profit and maintain their existence within the present economy merely depending upon the intangible assets or intellectual assets. Through intellectual capital, the firms are able to quickly adapt to the changes and remain competitive in the markets. Intellectual capital has increasingly become a source of competitive advantage due to innovation (Obeidat et al., 2017). The Organization for Economic Co-operation and Development (OECD) (1996) defined the knowledge economy as an economy during which the assembly, distribution and use of information is that the main driver of growth, wealth creation and employment across all industries and not only those industries classified as high-tech or knowledge intensive.

Foray (2006) pointed that knowledge intensive organizations have successfully created and disseminated both information and knowledge in efficient ways. Bontis (1999) stated that human capital is employee-dependent, such as employees' competence, commitment, motivation and loyalty, etc. Contemporary business firms require a higher level of knowledge mainly in terms of competence and skills, a high degree of technological innovation, and a high degree of interaction between personnel and clients to generate competitive differentiation strategies based on the level of service and assistance provided to the clients (Veltri and Silvestri,

2011). Therefore, it is necessary for companies to invest in their development of human capital, organizational processes and corporate knowledge base in order to make competitive advantage sustainable and durable.

In a Malaysian study, Gan and Saleh (2008) found that human capital efficiency (HCE) has great importance in improving the financial performance of companies. According to Perera and Thrikawala (2012), the investment in human capital influences the performance of the companies in Sri Lanka. They further concluded that the investment on human capital (HC) represents only a few percentages on companies' total assets. The companies have not given considerable importance to the investment of HC.

Although many empirical studies have been conducted in the western countries on the subject of investment on human capital, relatively little or very less empirical studies have been conducted regarding this subject in Sri Lanka (Perera and Thrikawala, 2012) and the numerical relationship is rarely studied and the sample of companies selected for previous studies were considerably limited. Thus there is a vital need of studying the impact of human capital on financial performance of Sri Lankan companies and problem of this research is identified as: *What is the impact of labor costs and investment in human capital on financial performance of listed companies in Sri Lanka?*

Therefore, followings questions are addressed in this research.

i. Do labour costs influence on the financial performance of listed companies in Sri Lanka?
ii. Does investments in human capital influence on the financial performance of listed companies in Sri Lanka?
iii. Does the level of market capitalization influence the relationship between human capital and financial performance of listed companies in Sri Lanka?

Research Objectives

i) To study the impact of labor costs on the financial performance of listed companies in Sri Lanka.
ii) To study the impact of investments in human capital on the financial performance of listed companies in Sri Lanka.
iii) To study the impact of the level of market capitalization on the relationship between human capital and the financial performance of listed companies in Sri Lanka.

Review of Literature

The growth of the professional services industry and also the many new knowledge-based firms that have fueled the economic process also reflects the increasing importance of evaluating IC (Bontis, 1999). In Fortune, Thomas Stewart defined Intellectual Capital (IC) as "the intellectual material that has been formalized, captured and leveraged to supply a higher-valued asset." The phenomenon's popularity has even led major accounting firms like Ernst & Young to say that current accounting standards do not capture IC accurately and must therefore be revisited (Bontis, 1999).

Klein and Prusak (1994) contributed to the creation of a universal definition by defining IC as the intellectual material that may be formalized, captured and leveraged to supply the next value asset. Within the same vain, Edvinsson and Malone (1997) defined IC as the knowledge which will be converted into value. Stewart (1997) argued that intellectual resources like knowledge, information, and skill, are the tools for creating wealth and defined IC as the new wealth of organizations. Sullivan (2000, p. 17) defined IC as "knowledge that may be converted into profits". Consistent with Edvinsson and Malone (1997) IC may be defined as the gap that is observed between a firm's book and value. Also, Kok (2007) argued that a technique for determining the intellectual (intangible) assets of a corporation is to check market to value. These arguments have supported the

character of IC. The intellectual assets of an organization are intangible in nature and, thus, do not have a particular shape or an appropriate financial value. They are characterized as "hidden assets", since it's difficult to spot their contribution to a firm and quantify them in a financial statement (Fincham and Roslender, 2003).

The initial usage of the term IC goes back some decades (Bontis, 2001; Kujansivu, 2005). Pulic (2000) proposed the Value-Added Intellectual Capital (VAIC) method to supply information about the value creation efficiency of tangible and intangible assets within a corporation. Rather than valuing the IC of a firm, the VAIC method mainly measures the efficiency of firms' three forms of inputs: physical and financial capital, human capital, and structural capital, namely the Capital Employed Efficiency (VACA), the Human Capital Efficiency (VAHU), and therefore the Structural Capital Efficiency (STVA). In step with Boldizzoni (2008) Human Capital is semantically the mixture of human and capital. HC are often limited to micro (individual) (e.g. personal attributes technical competence and creativity) or macro (organization) levels (e.g. teamwork, healthy work environment). Sveiby (1997) defined HC as "the capacity to act in an exceedingly big variety of situations to make both tangible and intangible assets". Voluntary disclosure of labor cost information is positively related to analyst forecast accuracy. Further tests show that the advantage of voluntary labor cost information is more pronounced for firms with high information uncertainty and for analysts with less firm-specific experience and analysts affiliated with small brokerage houses (Kim et al., 2017).

Most of the researchers who have done research on measuring corporate performance tested with the efficiency of IC have used Return on Assets (ROA), Return on Equity (ROE) and Earning Per Share (EPS) in their researches (Chen et al., 2005, Phusavat et al., 2011, Firer and Williams; 2003, Mondel and Ghosh; 2012, Najibullah; 2005, Ranjani and Jayendrika; 2010). Phusavat et al. (2011) confirmed the relationship between human capital and financial performance in the manufacturing industries in Thailand by measuring Return on Assets (ROA). As a quantitative measurement, Rompho (2017) used the ratio of employee-related expenses to the number of employees which reflects the firm's employee investments. However, results of the study indicated no relationship between human capital level and financial performance in terms of financial performance measured by both Return on Equity (ROE) and price-to-book ratio.

According to the analysis of Mondal and Ghosh (2012), the relationships between the performance of a bank's intellectual capital, and financial performance indicators, namely profitability and productivity, are varied. The results of their study suggest that banks' intellectual capital is a significant factor for competitive advantage. HC in Australia has a greater influence on the value creation capability of the monetary sector. Around two thirds of the sample companies have very low levels of IC efficiency. The performance of varied components useful added intellectual coefficient (VAIC) and overall VAIC varies across all subsectors within the financial sector. As a result of higher level of human capital efficiency, investment companies have high value VAIC, as compared to banks, insurance companies, diversified financials and RIETs. Insurance companies are more focused on physical capital instead of human and structural capital resulting in lower VAIC (Joshi et al., 2013). In a Malaysian study, Gan and Saleh (2008) found that human capital efficiency (HCE) had great importance in improving the financial performance of companies. Phusavat et al. (2011) investigated IC in large manufacturing companies in Thailand and found a positive relationship between company performance and IC. In an Italian study, Veltri and Silvestri (2011) discovered a positive relationship between accounting values and market value on the one hand, and IC and market value on the other. They also found that investors value HCE more than the other components of IC.

Research Methodology

Based on the previous research studies and review of literature, conceptual model (Figure 1) for testing the impact of HC on the

Financial Performance of Listed companies of Sri Lanka was developed. HC (Human Capital) is considered as independent variable of this model and FP (Financial Performance) is the dependent variable. Labor Costs (LC) and Investment in Human Capital (IHC) are considered as the sub variables of Human Capital. There are two FP measures identified as the dependent variables; such as Return on Assets (ROA) and Earning Per Share (EPS). Accordingly, there are two dependent variables incorporated to the conceptual framework to test the FP in two different aspects.

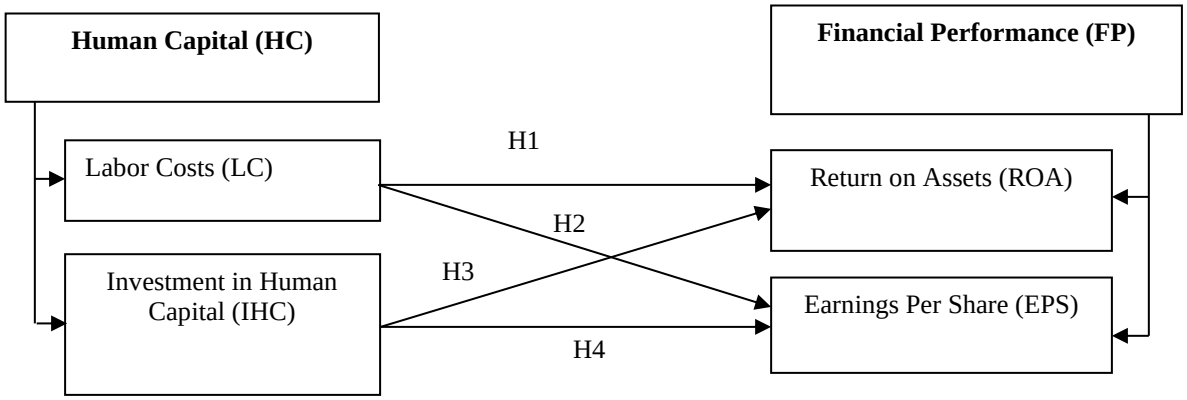


Figure 1. Conceptual Model developed based on literature

H1: *There is a significant impact of Labor Costs (LC) on Return on Assets (ROA) of listed companies in Sri Lanka.*

H2: *There is a significant impact of Labor Costs (LC) on Earning per Share (EPS) of listed companies in Sri Lanka.*

H3: *There is a significant impact of Investment on Human Capital (IHC) on Return on Assets (ROA) of listed companies in Sri Lanka.*

H4: *There is a significant impact of Investment on Human Capital (IHC) on Earning per Share (EPS) of listed companies in Sri Lanka.*

Table 1: Operationalization of Variables

Variable	How to Measure	Literature
Labour Costs	Average labour cost on labor related tasks and activities	Dae-Borg (2009) Bhoite & Shaukat (2017) Perera &Thrikawala (2012)
Investment in Human Capital	Indicator at corporate annual report on training and development activities, health and welfare activities.	Dae-Borg (2009) Hatch & Dyer (2004) Bhoite & Shaukat (2017) Perera &Thrikawala (2012)
Number of employees	Average no of employees of selected company	Dae-Borg (2009) Bhoite & Shaukat (2017) Perera &Thrikawala (2012)

Return on Assets (ROA)	ROA is calculated by dividing a company's net income by total assets.	Firer and Williams (2003) Chen et al. (2005) Kongkiti et al. (2011) Mondel and Ghosh (2012) Perera &Thrikawala (2012)
Earnings per Share (EPS)	Earnings per share is calculated by subtracting preferred dividends from net income and dividing by the weighted average common shares outstanding	Johannes (2014) Wet (2013) Famil et. al (2017)

Source: created, based on literature

The number of Employees were used as a control variable of total labour costs thus, average labour cost (total labour costs divided by number of employees) was used as the independent variable and tested the impact of average labour cost on ROA and EPS. Also, market capitalization was used to select the companies for the sample and accordingly, the sample consists of the companies with a high market capitalization as well as a low market capitalization.

The population includes all the companies listed in the Colombo stock exchange by 31st of March 2019. Considering the market capitalization, fifty-nine (59) companies including two companies with highest market capitalization and the two companies with lowest market capitalization in each sector were selected for the study during the period of 2014-2018. Number of observations of the study is two hundred and ninety-five (295). Secondary data and company annual reports of all selected companies and other publications were used to collect the data.

Data Analysis and Discussion

Table 2 presents the results of correlation analysis among HC, LC and FP (ROA and EPS). The correlation coefficient between average labour costs and investment in human capital on ROA are 0.419 and 0.217, respectively. Thus, there is a positive correlation between average labour costs and investment in human capital on ROA. Correlation coefficients of both variables with ROA are statistically significant. The correlation among EPS and average labour costs is 0.023 which presents a weak positive relationship. However, investment in human capital has a weak negative relationship with EPS which is -0.096. However, both correlation values are not statistically significant.

Table 2: Correlations Analysis – HC/LC vs FP

Indicators	Return on Assets (in %)-ROA		Earnings per Share EPS	
Average Labour Cost (ALC)	Pearson Correlation	.419**	Pearson Correlation	.023
	Sig. (2-tailed)	.000	Sig. (2-tailed)	.689
Investment in Human Capital (IHC)	Pearson Correlation	.217**	Pearson Correlation	-.096
	Sig. (2-tailed)	.000	Sig. (2-tailed)	.098

Source: Secondary data

As per the findings of LC - ROA model (in table 3), the adjusted R^2 value which represents the coefficient of determination is 0.173 which presents that 17% of ROA is determined by ALC. The overall model is statistically significant as the probability value is almost zero which less than 0.05 and the coefficient is statistically significant.

Table 03: Regression Output of LC – ROA

Model

R	R Square	Adjusted R Square	Std. Error of the Estimate
.419	.175	.173	11.613

Model Coefficients		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.029	1.04		.028	.978
	Average Labour Cost	5.72	.000	.419	7.89	**.000**

Table 04: Regression output of IHC – ROA Model

	R	R Square	Adjusted R Square	Std. Error of the Estimate
	.217	.047	.044	12.483

Model Coefficients	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.565	1.441		1.085	.279
Investment in Human Capital	6.357	1.669	.217	3.809	**.000**

Table 05: Regression Output of LC – EPS Model

R	R Square	Adjusted R Square	Std. Error of the Estimate
.023	.001	-.003	50.77

Model Coefficients		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	13.492	4.563		2.957	.003
	Average Labour Cost	1.271	.000	.023	.401	**.689**

Table 06: Regression output of IHC - EPS Model

R	R Square	Adjusted R Square	Std. Error of the Estimate
.096	.009	.006	50.553

Model Coefficients		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	23.250	5.837		3.983	.000
	Average Labour Cost	-11.214	6.760	-.096	-1.659	**.098**

There is a weak positive correlation between earning per share and average labour cost. The adjusted R^2 value, which represent the coefficient of determination, is -0.003 and it indicates that EPS is not determined by ALC. The overall model is also not statistically significant as the probability value is 0.689 which greater than 0.05 (table 04). The adjusted R2 value which represents the coefficient of determination is 0.044 and it presents that only 04% of ROA is determined by IHC. There is a weak positive correlation between ROA and IHC. The overall model is statistically significant as the probability value is almost zero which less than 0.05. There is a weak positive correlation between earning per share and average labour cost. The adjusted R2 value which represents the coefficient of determination is 0.006 and it indicates that 0.06% of EPS is explained by IHC which generally a very small percentage. The overall model is also not statistically

significant as the probability value is 0.098 which greater than 0.05 (Table 05 and 06).

Findings proved that there is a significant positive impact of ALC on ROA. Thus hypothesis 01 is accepted with statistical evidence. So, it can be concluded that when companies increase the spending on employees; for example, for their wages and salaries, bonuses, obligatory payments, gratuity and other labour costs etc. It positively affects the financial performance of the organization as these factors motivate them to work better and make them more productive. As there is no significant impact the hypothesis 02 is rejected in this study. So, the findings indicate that ALC does not significantly affect the EPS of companies, the researcher should conclude that expenses made on operational and management activities of employees does not affect the earning per share of companies. This may imply that than the value generated from human capital of the organization there can be number of other factors that affect the EPS. As the findings are statistically significant, hypothesis 03 is accepted. Similar to the conclusion made with the hypothesis 01, it is evident that investment on human capital especially on training and development activities by the organizations has a significant relationship with the ROA. Thus, researcher can conclude that organizations should invest in training and development of employees in order to enhance the performance of the organization. As the findings are not statistically significant hypothesis 04 is rejected. As similar to the conclusion made at hypothesis 02, there is no significant impact on investment in human capital i.e investment on training and development activities on the EPS of the Sri Lankan listed companies (Table 7).

Table 7 : Summary of Hypotheses Testing

Hypotheses	Result	Decision
H1: There is a significant impact of Labor Costs (LC) on Return on Assets (ROA) of listed companies in Sri Lanka.	Statistically Significant	Accepted
H2: There is a significant impact of Labor Costs (LC) on Earning per Share (EPS) of listed companies in Sri Lanka.	Statistically Insignificant	Rejected
H3: There is a significant impact of Investment on Human Capital (IHC) on Return on Assets (ROA) of listed companies in Sri Lanka.	Statistically Significant	Accepted
H4: There is a significant impact of Investment on Human Capital (IHC) on Earning per Share (EPS) of listed companies in Sri Lanka.	Statistically Insignificant	Rejected

When considering the results of hypotheses testing H1 and H3 are accepted and H2 and H4 are rejected as the findings are not statistically significant. Accordingly, the researcher has to consider on answering research question of this study while achieving the objectives based on the results of hypotheses testing.

Most of the past researchers who conducted research on human capital and financial performance have used ROA to measure the

financial performance of organizations (Firer and Williams, 2003; Chen et al., 2005; Kongkiti et al., 2011; Mondel and Ghosh, 2012; Perera & Thrikawala, 2012). Thus, among the dependent variables, ROA can be considered as the commonly used measurement of financial performance. The findings of the study revealed that investment in human capital influences the performance of the companies in Sri Lanka. These findings go in line with the findings of the Clarke M., et al in 2010 and Segal G., et al in 2009.

Table 8 presents the regression findings of the sample companies with high and low market capitalization. Further objective 03 aims to study the impact of the level of market capitalization on the relationship between human capital and financial performance of listed companies in Sri Lanka. Accordingly, correlation and regression analysis were conducted separately for the companies with high market capitalization and for the companies with low market capitalization. The researcher wanted to test and understand whether there is a significant difference between the results for two different segments based on their market capitalization. With the correlation and regression findings for companies with high market capitalization is observed that all the hypotheses are achieved as there are statistically significant impacts of independent and dependent variables. Correlation coefficients of all four models such as ALC – ROA, IHC – ROA, ALC – EPS and IHC – EPS present a moderate positive correlation, thus it can be concluded that human capital cause to increase the financial performance of Sri Lankan companies.

When analyzing the companies with low market capitalization, researchers could observe debatable findings as all the regression models are not statistically significant. Regression coefficients are negative in three models (ALC – ROA, ALC – EPS and IHC – EPS) and it is positive for one model (IHC – ROA) but each variable is statistically insignificant. So, researcher had to reject all the hypotheses with regard to companies with low market capitalization. These findings imply that listed companies with low market capitalization have a considerably lower level of financial performance and also human capital does not affect considerably for the performance of those companies. There can be number of reasons behind these findings. As the third objective of this study is to identify the impact of human capital on the financial performance of companies based on the level of market capitalization; it is evident that companies with high market capitalization has a significant impact while companies with low market capitalization does not have a

Table 8: High and Low market comparison - Source: Compiled from data analysis

Market Cap	Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Sig
High	*LC – ROA*	.486	.236	.231	11.645087	.000
Low		.027	.001	-.006	10.820295	.743
High	*LC – EPS*	.258	.067	.060	24.24737	.018
Low		.116	.013	.006	67.60428	.116
High	*IHC – ROA*	.193	.037	.031	13.072559	.000
Low		.102	.010	.004	10.767567	.221
High	*IHC – EPS*	.240	.058	.051	24.36606	.003
Low		.102	.010	.004	10.767	.461

significant impact on their performance. So, the level of market capitalization has a mediating effect on the financial performance of Sri Lankan listed companies with regard to the support and contribution of human capital of those companies. As per the findings of LC - ROA model for the companies with high market capitalization, correlation value is 0.486 and it indicates that there is a moderately positive correlation between variables. The adjusted R^2 value which represents the coefficient of determination is 0.231 and it presents that 23% of ROA is determined by ALC of well performing companies. The overall model is statistically significant as the probability value is almost zero which is less than 0.05. As per the findings of LC – EPS model for the companies with high market capitalization, correlation value is 0.258 and it indicates that there is a weak positive correlation between variables. The adjusted R^2 value which represent the coefficient of determination is 0.06 which presents that 06% of EPS is determined by ALC of well performing companies. The overall model is statistically significant as the probability value is almost zero and is less than 0.05.

Findings of ROA – IHC model for the companies with high market capitalization presents a correlation value of 0.193 and it is a weak positive relationship and IHC - EPS model for the companies with high market capitalization presents a weak positive correlation between variables which is 0.240. The regression findings of ROA – ALC model for the companies with low market capitalization, the correlation value is 0.027 which is a very low relationship. The adjusted R^2 value which represents the coefficient of determination is -0.006 and it presents that there is no relationship between ROA and ALC of companies with low market capitalization.

EPS – ALC model for the companies with low market capitalization, the correlation value is 0.116 and the adjusted R^2 is 0.006 which is almost zero and it indicates that there is no correlation between variables. The overall model is also not statistically significant as the probability value is 0.166. IHC - ROA model for the companies with low market capitalization, the correlation value for the model is 0.102 which is a very weak correlation between variables and the adjusted R^2 value is .004 and it is almost zero, so the researcher can interpret that there is no relationship between investment in human capital and ROA of Sri Lankan companies with low market capitalization. EPS – IHC model for the companies with low market capitalization, the correlation value is 0.102 and the adjusted R^2 is 0.004 which is almost zero, so the correlation presents that there is no relationship between variables. The overall model is also not statistically significant as the probability value is 0.461 which is greater than 0.05.

Conclusion

As it was observed that labour cost and investment in human capital enhance the extent of ROA of companies' researcher can decide that, in Sri Lankan listed companies the efficiency of utilizing human capital is at a satisfactory level. Thus, Sri Lankan companies may employ different strategies to reinforce the invested capital in human capital. The findings of this study provide important insights on the actions taken by companies in managing human capital like their effort of employing high skilled labour in most of the positions. Further with the improvement of information technology and other supporting services, companies may tend to produce enough training and development facilities for managerial and operational level employees. Accordingly, the allocation of funds on enhancing the efficiency and productivity of human capital of companies are at a substantial level. For theoretical implications, it is important to notice that ROA and EPS ratios are embedded during a firm's tangible assets (e.g., land, factory, machinery, inventory, and working capital) and are a part of a firm's products and services delivered to its customers. Therefore, HC cannot be separately considered from revenue generation and a firm's long-term profitability. Further for managerial implications, the findings imply that Sri Lankan listed companies employ a substantial level of human capital and also it is a big impact on financial performance.

However, the extent of expenses and investment made by companies are at different levels when comparing among companies. The findings of this study have implications for Sri Lankan listed companies because it provides them with a chance to critically analyze the contribution of human capital to their organization and can aid the look of strategies for enhanced corporate performance. This can also help the management of companies in all the sectors, especially those in finance and leasing businesses, knowledge-based industries to grasp the contributions of varied components of human capital to their business growth. This study will help decision makers remember of the importance of human capital as a key factor that may enhance a firm's ability to take care of their competitive position.

References

Boldizzoni (2008). *Means and ends: The idea of capital in the West; 1500-1970*. New York: Palgrave Macmillan.

Bontis, N. (1999). Managing organizational knowledge by diagnosing intellectual capital: framing and advancing the state of the field. *International Journal of Technology Management*, *18*(5/6/7/8), 433-462.

Bontis, N. (2001). Assessing knowledge assets. *A review of the models used to measure intellectual capital, 3*(1), 41–60.

Bontis, N., Keow, W. C. C., & Richardson, S. (2000). Intellectual capital and business performance in Malaysian industries. *Journal of Intellectual Capital, 1*(1), 85-100. Retrieved from http://doi.org/10.1108/14691930010324188.

Bontis, N. and Fitz-enz, J. (2002). Intellectual capital ROI: a causal map of human capital antecedents and consequents. *Journal of Intellectual Capital, 3*(3), 223-247.

Central Bank of Sri Lanka (2005). Annual report of Central Bank of Sri Lanka 2018. Retrieved from https://www.cbsl.gov.lk/en/publications/economic-and-financial-reports/annual-reports/annual-report-2018

.Chen, M., Cheng, S., & Hwang, Y. (2005). An empirical investigation of the relationship between intellectual capital and firms' market value and financial performance. *Journal of Intellectual Capital, 6*(2), 159-176.

Clarke, M., Seng, D., & Whiting, R. H. (2010). Intellectual capital and firm performance in Australia. Working paper series no 12. Department of Accountancy and Business Law, University of Otago. Dunedin.

Dae-Borg, K. (2009). Human Capital and its measurement "The 3rd OECD World Forum on 'Statistics, Knowledge and Policy'" Korea 27-30 October, 2009.

Edvinsson, L., & Malone, M.S. (1997). Intellectual Capital: Realizing your Company's True Value by Finding its Hidden Brainpower, Harper Business, New York, NY.

Fincham, R., & Roslender, R. (2003). Intellectual capital accounting as management fashion: a review and critique. *European Accounting Review, 12(4),* 781-95.

Firer, S., & Williams, S.M. (2003). Intellectual capital and traditional measures of corporate performance. *Journal of Intellectual Capital, 4*(3), 348-60.

Foray, D. (2006). Optimizing the use of knowledge, in Foray, D. and Kahin, B. (Eds), Advancing Knowledge and the Knowledge Economy, *MIT press, Cambridge, MA.*

Gan, K., & Saleh, Z. (2008). Intellectual capital and corporate performance of technology intensive companies: Malaysia evidence. *Asian Journal of Business and Accounting, 1*(1), 113-130.

Hatch, N.W., & Dyer, J.D. (2004). Human capital and learning as a source of sustainable competitive advantage. Strat. Manag. J. 25, 1155-1178.

Jorgenson, D., & Fraumeni, M. B. (1989). The accumulation of human and nonhuman capital, 1948-84 (Eds). by Lipsey and Tice. The measurement of saving, investment, and wealth. Chicago: University of Chicago Press.

Joshi, M., Cahill, D., Sidhu, J., & Kansal, M. (2013). Intellectual capital and financial

performance: an evaluation of the Australian financial sector. *Journal of Intellectual Capital, 14*(2), 264-285.

Klein, D.A., & Prusak, L. (1994). Characterizing intellectual capital, working paper, Centre for Business Innovation, Ernst & Young, Cambridge, MA, March.

Kok, A. (2007). Intellectual capital management as part of knowledge management initiatives at institutions of higher learning. *The Electronic Journal of Knowledge Management, 5*(2), 181-92.

Kujansivu, P. (2005). Intellectual capital performance in Finnish companies. paper presented at 3rd Conference on Performance Measurement and Management Control, Nice, pp. 1-14.

Mondal, A., & Ghosh, S.K. (2012). Intellectual capital and financial performance of Indian banks. Journal *of Intellectual Capital, 13*(4), 515-530.

Najibullah, S. (2005). An empirical investigation of the relationship between intellectual capital and firms' market value and financial performance, Independent University.

Obeidat, B.Y., Tarhini, A., Masa'deh, R.E., & Aqqad, N.O. (2017). The impact of intellectual capital on innovation via the mediating role of knowledge management: a structural equation modeling approach. *International Journal of Knowledge Management Studies, 8*(3-4), 273-298.

OECD (1996). The Knowledge-based Economy. Organization for Economic Co-operation and Development, Paris.

Perera, A., & Thrikawala, S. (2012). Impact of Human Capital Investment on Firm Financial Performances: An Empirical Study of Companies in Sri Lanka, ,

Phusavat, K., Comepa, N., Sitko-Lutek, A., & Boon Ooi, K. (2011). Interrelationship between intellectual capital and performance. *Industrial Management & Data Systems, 111*(6), 810-829.

Pulic, A. (2000). VAIC: an accounting tool for *IC management. International Journal of Technology Management, 20*(5-8), 702-14.

Ranjani, R. P. C., & Jayendrika, W. A. D. K. (2010). The impact of intellectual capital and its components on firms' market value: A comparative study based on manufacturing and service sectors in Sri Lanka.

Rompho, N. (2017). HC and financial performance with two HRM strategies. *International Journal of Productivity and Performance Management*, *66*(4), 459-478.

.Segal, G., Borgia, D., & Schenfeld, J. (2009). Founder human capital and small firm performance: an empirical study of founder-managed natural food stores. *Journal of Management Research, 4*, 1-10.

Stewart, T. A. (1997). Intellectual Capital: the New Wealth of Organizations, Doubleday, New York, NY.

Sullivan, P.H. (2000). Value-driven Intellectual Capital: How to Convert Intangible Corporate Assets into Market Value, John Wiley & Sons, Toronto.

Sveiby, K. E. (1997). *The New Organizational Wealth: Managing and Measuring Knowledge-based Assets.* Berrett-Koehler, San Francisco, CA.

Veltri, S., & Silvestri, S. (2011). Direct and indirect effects of human capital on firm value: evidence from Italian companies. *Journal of Human Resource Costing & Accounting*, *15*(3), 232-254.

ISSN 2738-2028 (Online) | Vol. 4 | No. 1 & 2 | 2020 January & July

JBT

Journal of Business and Technology

International peer-reviewed journal | Publish semi-annually

Attitudes towards Developing E-portfolio as an Extension for Personal Learning Environment of Universities in Sri Lanka

P. K. G. C. Pitigala[1*]

[1] ICT Centre, University of Kelaniya, Sri Lanka.
[*] Corresponding author: pitigala@kln.ac.lk

Abstract

The study on the attitudes towards developing e-portfolio as an extension for Personal Learning Environment of Universities in Sri Lanka is aimed at energizing students to be actively involved in learning culture, assess students regularly, and predict final results to maintain the effective and efficient two-way flow of information. An electronic portfolio is a collection of electronic evidence assembled and managed by a user, usually on the Web. The study mainly emphasizes the attitudes of the main stakeholders of the e-portfolio, such as Administrators, Academic Staff Members, and Undergraduates. The study is conducted as a case study at the University of Kelaniya, Sri Lanka, using convenience sampling method. The questionnaire method is used to collect data and descriptive analysis and bivariate analysis are used to analyze data and graphical methods and equations have been used to present the gathered data. The study is concluded with positive opinions from administrators, academic staff members, and undergraduates while designing an e-portfolio for the university system. The system flowed with the feasibility study and requirement analysis, which are driven by the development of the e-portfolio. The e-portfolio system design, which consists of system architecture, database, and system design, is illustrated in the study. Finally, the study proposed to develop the e-portfolio as an extension for personal learning which, already exists in the university context in Sri Lanka.

Keywords: *Education, E-Portfolio, Personal Learning Environment, Student Involvement*

Introduction

The World Wide Web (WWW) has made access to information and the distribution of educational material, content accessible to an outsized fraction of the world's population and helped move distance learning to the digital era. Distance Learning has become gradually common in many universities worldwide (Allen & Jeff Seaman, 2017).

An electronic portfolio is a web-based assembly of electronic evidence gathered and proceeded by a user. Electronic evidence can be known as input text, electronic files, images, multimedia, blog entries, and hyperlinks, where e-portfolio emphasized not only accessing study materials but also evaluating and monitoring performance too.

"The institution should be held responsible for providing the most favorable condition to promote the active participation of students through programmes and policies that encourage responsible student behavior" (Tam, 2002). Also, the institution is responsible for providing the environment and support to engagement and students must have the responsibility for their own engagement with the e-portfolio. The ending phase aimed at an effective e-portfolio practice which can also be an appraisal process that evaluates the implementation process and outcomes of the e-portfolio (JISC, 2008). Considering the University of Kelaniya, which is considered as the target

population of this research, is practicing the Learning Management System (LMS) in the university. But the most common complaint from the academic staff members is, activities on LMS needs further follow-ups to get the involvement of the students on it such as if they upload any assignment to LMS, most of the students are unaware about the assignment and then lectures have to pass a message separately to get students' attention. Students also do not pay much attention as the activities on LMS do not impact directly on their final results at the end semester examination and student users are confused about the procedure (Rasmussen, 2016) (Connect Thinking, 2013). Therefore, it is essential to develop a platform where all the stakeholders are equally involved and equally beneficial. The e-portfolio is a high concept in foreign countries that requires an appropriate procedure to be developed in a country like Sri Lanka as people restrict to change suddenly.

The research questions can be listed as follows;

1. How about the institutional commitment towards the initiation of e-portfolio?

2. What are the student and academic staff attitudes towards making for Personal Learning Environment?

3. What are the factors that impact designing culturally responsive e-portfolios?

4. How the identified factors can be used to design and develop e-portfolios?

The General Objective of the study is to energize students to be actively involved in learning culture, assess students regularly, and predict final results to maintain an effective and efficient two-way flow of information. Thereby, the specific objectives of the study are to ensure the institutional commitment towards initiation of e-portfolio to get the maximum involvement of learners, to confirm an attitude towards making for personal Learning Environment in order to ensure active contribution, scaffolding, evaluate and monitor the performance of mentors and also ensure the active contribution of a learner, to ensure factors affecting designing cultural e-portfolio in order to understand the factors final implementation, to assess students regularly and predict final results with assignments to offer them a brief understanding about the final results.

Review of Literature

The education system is encountered a rapid change due to its arising challenges and technological development. The education system requires to produce more competent learners who are capable of handling any situation in the working environment. The demand for comprehensive education and the increase of the rate of migration energizes the positive expands to the existing learning environment by modern learning theories, new educational concepts, and technological enhancements (Hubwieser & Böttcher, 2015). The recent education system evaluation was through the Classroom Approach (CRA) via Personal Learning Environment (PLE) to the current scenario with e-Learning procedure. The designs of traditional CRA and the online course or PLE are not with similar characteristics. According to (Wright, 2014), there can be many differences between the learning outcomes of CRA and PLE. However, with the growing requirements of the job market and the working environment, the educational pedagogical procedure needed to be changed virtually with emerging necessities of technology in the perception of the global village. According to (Abrami, et al., 2008), among the most interesting and exciting new developments of the education system are electronic portfolios, not only because they act as multimedia containers for students and teachers but also because they support student self-regulation and core educational competencies, especially literacy skills.

The PLE has failed to engage learners and staff honestly to the system in terms of learning and evaluating meaningfully (Abrami, et al., 2008). They suggest that one way to meet the challenge is to apply the use of electronic portfolios (EPs) that can be designed to support the process of students' self-regulated learning and the improvement of reading, writing, and other literacy skills and they define self-regulated learning as a set

of behaviors that are used to guide, monitor and evaluate the success of one's learning. An electronic portfolio is a collection of electronic evidence assembled and managed by a user, usually on the Web. Such electronic evidence may include input text, electronic files, images, multimedia, blog entries, and hyperlinks where e-portfolio emphasized accessing study materials and evaluating and monitoring performance.

Methodology

The e-portfolio design research described the potential implementation of e-portfolio as an extension for the Personal Learning Environment of Universities in Sri Lanka. However, the study focuses on replacing the personal learning environment with an effective learning environment through the e-portfolio in the Sri Lankan university context. The type of the study is correlational as the study establishes a relationship between independent and dependent variables and the study conduct in the natural environment of the institution while minimizing the researcher influence to the natural flow (Sekaran, 2009) (Hussey & Hussey, 1997). The study formulated three main hypotheses in order to identify the nature of certain relationships between the dependent and independent variables. Thereby the study is analytical in nature. The study setting of the research study is field study. It emphasized establishing relationships between independent and dependent variables at the natural atmosphere to the research or in other words at target study context.

The study population comprises of administrators, students and academic staff members in Sri Lankan Universities. But the university of Kelaniya was selected as the case to the study due to the constraints of time and resources and the convenience of handling the research study. More specifically, the population consists of approximately 100 administrative parties or decision makers, 550 academic staff members and 9900 students in the university. Thus, a sample of 364 was drawn using the convenience sampling method and it comprises of 11, 33, and 320 for administrators, academic staff members and students respectively.

In this sense, questionnaire method is fairly sufficient in collecting data from stakeholders of the study as the primary data collection method. The questionnaire consists of general information and qualitative information or perception of relevant stakeholders regarding the implementation of e-portfolio as an extension to the Personal Learning Environment. Secondary data sources also used where such documents support the contemporary environment of personal learning and potential to e-portfolio as a method of data collection. Data for the independent variables, or in other words, the perception of administrators, academic staff members, and students were measured ordinal with Likert scale measurement.

To achieve the objectives of the study, the analysis of data consists of two parts as descriptive analysis and advanced analysis. The descriptive analysis consists of the analysis of frequency distribution, and percentages and, at the same time, bivariate analysis involves chi-square analysis in finding relationships between independent and dependent variables. SPSS version 22.0, and Microsoft Excel 2013 were used to test the hypotheses, and analyze the data set.

The study has constructed three main hypotheses as follows.

H0 1: There is no significant relationship between attitudes of institutors/ decision-makers and intention to implement e-portfolio as an extension to personal learning environment.

H1 1: There is a significant relationship between attitudes of institutors/ decision-makers and intention to implement e-portfolio as an extension to the personal learning environment.

H0 2: There is no significant relationship between attitudes of academic staff members and intention to implement e-portfolio as an extension to the personal learning environment.

H1 2: There is a significant relationship between attitudes of academic staff members

and intention to implement e-portfolio as an extension to personal the learning environment.

H0 3: There is no significant relationship between attitudes of undergraduates and intention to implement e-portfolio as an extension to the personal learning environment.

H1 3: There is a significant relationship between attitudes of undergraduates and intention to implement e-portfolio as an extension to the personal learning environment.

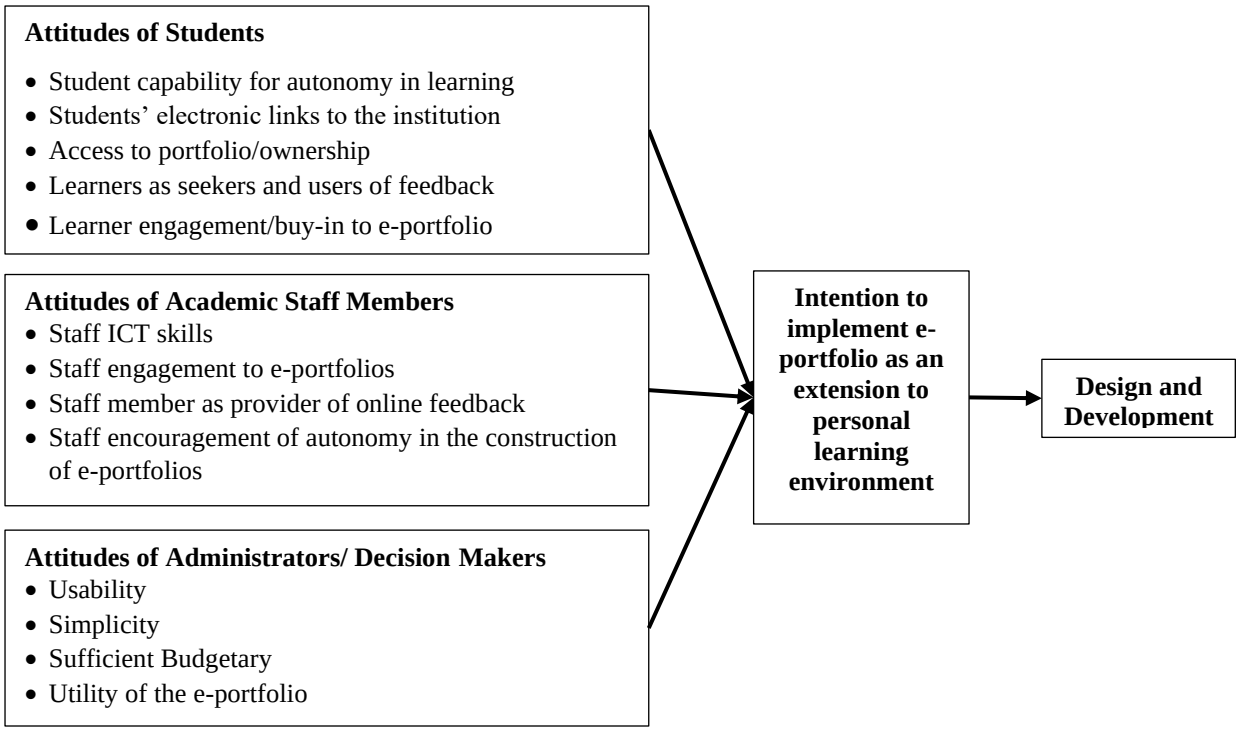


Figure 1: Conceptual Framework
Source: Author Developed (2018)

Data Analysis

When considering the sample profile of the undergraduates, it shows that there are 87 percent of female undergraduates and 13 percent of male undergraduates. Among them, the undergraduates' composition of faculties implies that the majority of undergraduates are from the Faculty of Social Sciences, where it records 43 percent out of the total and the least representation is from the Faculty of Medicine, which records only 1 percent. However, the Faculty of Commerce and Management, Faculty of Humanities, Faculty of Science and Faculty of Computing and Technology representation report 30 percent, 19 percent 6 percent and 3 percent respectively. However, the language preference of undergraduates implies that 81 percent of the total population prefer English language as the language for e-portfolio and another 19 percent prefer Sinhala Language.

On the same time when considering the gender composition of academic staff of the study, it consists of 50 percent females and 50 percent of males. The academic staffs' composition of faculties implies that the majority of members are from the Faculty of Social Sciences where it records 24 percent out of the total and the least representation is from the Faculty of Medicine, Faculty of Humanities, and Faculty of Computing and Technology which are records 9 percent each. However, the Faculty of Commerce and

Management representation recorded 34 percent. The language preference of academic staff members implies that 100 percent academic staff members prefer English language as the language for e-portfolio.

Also, the gender composition of administrator of the study consists of 46 percent females and 54 percent of males. The administrators' composition of Faculties implies that majority of members are from the Faculty of Science where it records 46 percent out of the total. However, the Faculty of Commerce and Management, Faculty of Humanities, Faculty of Social Sciences, and Faculty of Medicine representation records 18 percent, 9 percent respectively. When considering the language preference of administrators, it implies that the majority of administrators prefer English language as the language for e-portfolio which is recorded as 73 percent and the remaining administrators prefer Sinhala Language.

On the other hand, the study considered the dependent variable as the intention to implement e-portfolio as an extension to the personal learning environment by undergraduates, academic staff members and administrators. The dependent variable was measured along with nine statements regarding the intention to implement e-portfolio and constructed an index in order to perform the chi-square test to see the relationship between the attitudes of stakeholders towards e-portfolio and the intention to implement e-portfolio as an extension to personal learning environment.

Testing Hypothesis

Relationship between attitudes of institutors/ decision-makers and intention to implement e-portfolio as an extension to the personal learning environment.

H0 1: There is no significant relationship between attitudes of institutors/ decision-makers and intention to implement e-portfolio as an extension to the personal learning environment.

H1 1: There is a significant relationship between attitudes of institutors/ decision-makers and intention to implement e-portfolio as an extension to the personal learning environment.

The chi-square table for the index constructed for both individual variable and the dependent variable or in other words for attitudes of institutors/ decision-makers and intention to implement e-portfolio as an extension to the personal learning environment shows that the significant value of the chi-square table is 0.000 which is less than 0.05 level of significance. Thereby the study concludes that there is a significant relationship between attitudes of institutors/ decision-makers and intention to implement e-portfolio as an extension to the personal learning environment.

Relationship between attitudes of academic staff members and intention to implement e-portfolio as an extension to personal learning environment.

H0 2: There is no significant relationship between attitudes of academic staff members and intention to implement e-portfolio as an extension to the personal learning environment.

H1 2: There is a significant relationship between attitudes of academic staff members and intention to implement e-portfolio as an extension to the personal learning environment.

The chi-square table for the index constructed for both individual variable and the dependent variable or, in other words, for attitudes of academic staff members and intention to implement e-portfolio as an extension to personal learning environment shows that the significant value of the chi-square table is 0.000, which is less than 0.05 level of significance. Thereby the study concludes that there is a significant relationship between attitudes of academic staff members and intention to implement e-portfolio as an extension to the personal learning environment.

Relationship between attitudes of undergraduates and intention to implement e-portfolio as an extension to the personal learning environment.

H0 3: There is no significant relationship between attitudes of undergraduates and intention to implement e-portfolio as an extension to the personal learning environment.

H1 3: There is a significant relationship between attitudes of undergraduates and intention to implement e-portfolio as an extension to the personal learning environment.

The chi-square table for the index constructed for both individual variable and the dependent variable or, in other words, for attitudes of undergraduates and intention to implement e-portfolio as an extension to the personal learning environment shows that the significant value of the chi-square table is 0.06 which is greater than 0.05 level of significance. Thereby the study concludes that there is no significant relationship between attitudes of undergraduates and intention to implement e-portfolio as an extension to the personal learning environment.

Table 1: Attitudes of undergraduates towards e-portfolio

	Strongly Agree %	Agree %	Moderate %	Disagree %	Strongly Disagree%
Student capability for autonomy in learning	35.15%	58.75%	5.5%	0.45%	0.15%
Students' electronic links to the institution	36.45%	50.3%	9.05%	4.05%	0.15%
Access to portfolio/ownership	40.87%	48.83%	6.77%	3.1%	0.43%
Learners as seekers and users of feedback	26%	61%	9%	4%	0.00%
Learner engagement/buy-in to e-portfolio	37.87%	52.93%	8.07%	0.73%	0.4%

Source: Sample survey (2018)

Table 2: Attitudes of academic staff members towards e-portfolio

	Strongly Agree %	Agree %	Moderate %	Disagree %	Strongly Disagree%
Staff ICT skills	50%	31.7%	18.3%	0.0%	0.0%
Staff engagement to e-portfolios	16.65%	51.7%	31.65%	0.0%	0.0%
Staff member as provider of online feedback	45.5%	26.7%	7.8%	20%	0.0%
Staff encouragement of autonomy in the construction of e-portfolios	25%	21.65%	48.3%	5%	0.0%

Source: Sample survey (2018)

Table 3: Attitudes of administrators towards e-portfolio

	Strongly Agree %	Agree %	Moderate %	Disagree %	Strongly Disagree%
Staff ICT skills	50%	31.7%	18.3%	0.0%	0.0%
Staff engagement to e-portfolios	16.65%	51.7%	31.65%	0.0%	0.0%
Staff member as provider of online feedback	45.5%	26.7%	7.8%	20%	0.0%
Staff encouragement of autonomy in the construction of e-portfolios	25%	21.65%	48.3%	5%	0.0%

Source: Sample survey (2018)

Table 4: Summary of intention to implement e-portfolio as an extension to personal learning environment

	Easy to Use	Uploading Files	Accessing Files	Viewing and Commenting	Image editing	Integration	Access after graduation	Peer Feedback	Online editing
Undergraduates' intention to implement e-portfolio									
Strongly Disagree	0.0%	0.0%	0.0%	0.0%	.6%	.3%	0.0%	0.0%	0.0%
Disagree	.3%	0.0%	0.0%	.6%	8.4%	5.2%	3.5%	0.0%	2.6%
Moderate	2.3%	4.2%	6.8%	8.7%	20.0%	17.4%	9.0%	5.2%	7.7%
Agree	59.0%	59.0%	57.7%	56.1%	52.9%	50.3%	49.7%	59.0%	57.1%
Strongly Agree	38.4%	36.8%	35.5%	34.5%	18.1%	26.8%	37.7%	35.8%	32.6%
Academic Staff Members' intention to implement e-portfolio									
Strongly Disagree	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Disagree	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Moderate	6.7%	6.7%	3.3%	3.3%	26.7%	3.3%	20.0%	10.0%	10.0%
Agree	30.0%	36.7%	33.3%	50.0%	50.0%	46.7%	76.7%	60.0%	40.0%
Strongly Agree	63.3%	56.7%	63.3%	46.7%	23.3%	50.0%	3.3%	30.0%	50.0%
Administrators' intention to implement e-portfolio									
Strongly Disagree	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	9.1%
Disagree	9.1%	9.1%	9.1%	10.0%	9.1%	9.1%	9.1%	9.1%	0.0%
Moderate	9.1%	9.1%	9.1%	20.0%	18.2%	18.2%	18.2%	9.1%	9.1%
Agree	36.4%	63.6%	54.5%	40.0%	54.5%	54.5%	36.4%	54.5%	36.4%
Strongly Agree	45.5%	18.2%	27.3%	30.0%	18.2%	18.2%	36.4%	27.3%	45.5%

Source: Sample survey (2018)

CONCLUSION

The conclusion of the study follows along with the conceptual framework constructed at the methodology. With reference to the conceptual framework firstly, the study concludes the attitudes of undergraduates towards e-portfolio development.

Student capability for autonomy in learning - the analysis of the study could conclude that there is more than 90 percent of undergraduates agreed or strongly agreed with both the statements e-portfolio emphasize the importance of self-direction in learning, and e-portfolio emphasize the accessibility anywhere.

Students' electronic links to the institution – more than 85 percent of undergraduates report agreed and strongly agreed in this regard. Smilarly, there is a considerable percentage of disagreement with the statement regarding undergraduate's links to the institution electronically which is numerically 1/20 from the total. Thereby the policymakers should consider establishing a suitable procedure to enhance undergraduate commitment through electronic mediums.

Access to portfolio/ownership - as it covers more than 85 percent of the undergraduates with a positive opinion towards accessibility of e-portfolio. And on the other hand, there could be seen a significant percentage of undergraduates, nearly 1/20, who are disagree with the accessibility of e-portfolio. Therefore, the policymakers should keen on providing required security and accessibility to the undergraduates in the form of ownership to the respective e-portfolio.

Learners as seekers and users of feedback - the responses in this regard could be concluded with the agreement of more than 85

percent of undergraduates, but there is a considerable percentage of undergraduates with no opinion towards feedbacks via e-portfolio. Therefore, these criteria should also be taken into high consideration where this is important for the development of the e-portfolio in advance.

Learner engagement/buy-in to e-portfolio - There is nearly 90 percent of undergraduates who are either agree or strongly agree with these supplementary statements. Also, it could be seen nearly 10 percent of moderate opinion that who are not clear about the amount of their engagement to the e-portfolio. Thereby the policymaker should consider managing learner engagement in both in favor of the institution and learner.

The next main stakeholder of the e-portfolio is academic staff members who should take the initiative for the e-portfolio procedure.

Staff ICT skills - The results could be concluded as there is more than 80 percent of academic staff members with the confidence of having ICT skills required to collaborate with e-portfolio. And at the same time, there is nearly 20 percent of academic staff members require further guidance towards ICT skills to be actively involved in the e-portfolio procedure. Therefore, the administrators should establish formal training on ICT skills required to e-portfolio to all academic staff members according to the level of their knowledge and skills.

Staff engagement to e-portfolios - The analysis could be concluded that there is more than 65 percent of academic staff members with the opinion of agreeing or strongly agree with engagement to e-portfolio, but there is a highly considerable percentage of academic staff members with moderate opinion towards the same. They could be identified as persons with an unclear opinion on the amount of engagement towards e-portfolio and thereby the policymakers should conduct an awareness programme to e-portfolio to receive the highest contribution from tee academic staff members.

Staff members as the provider of online feedback - The study concludes that there is nearly 45 percent of academic staff members agree or strongly agree on providing online feedback and the majority of academic staff members are either unaware or disagree with providing feedbacks online. However, the policymakers should pay their higher consideration to conduct an awareness programme on the essentiality of providing online feedback on smooth functioning and higher utilization of available resources.

The final contributor and one of the most significant stakeholders of e-portfolio is administrators or the decision-makers. When considering the language preference of administrators towards e-portfolio is highly on English, which covers more than ¾ of the population.

Usability - the study concluded that more than 75 percent of the administrators have identified the usability of e-portfolio to a system like a university. Therefore, firstly they have conducted an awareness programme regarding the essentiality of e-portfolio to the administrators to maintain a common interest among administrators towards e-portfolio.

Simplicity - the analysis implies that there is nearly 40 percent of administrators are unaware or disagree towards the requirement of the simplicity of e-portfolio. Thereby with reference to the 40 percent of higher disagreement, the administrators should be keener on the essentiality of e-portfolio to a university.

Sufficient Budgetary - The analysis could be concluded that there is more than 60 percent of administrators are with the opinion that there are sufficient budgetary for e-portfolio.

With reference to the relatively lower awareness towards the requirement of establishing an e-portfolio at an excellent basement, the administrators have to be concerned about managing sufficient budgetary for e-portfolio.

The utility of the e-portfolio – this concluded that there is more than 80 percent of administrators are aware of the utility of the e-portfolio. Thereby the administrators do not require to pay higher attention in this regard, but they have to maintain the feeling of utility towards the e-portfolio.

References

Abrami, P. C., Wade, A., Pillay, V., Aslan, O., Bures, E. M., & Bentley, C. (2008). Encouraging Self-Regulated Learning

through Electronic Portfolios. Centre for the Study of Learning & Performance, Concordia University.

Allen, I. E., & Jeff Seaman. (2017). Digital Compass Learning: Distance Education Enrollment Report 2017. Babson Park: Babson Survey Research Group.

Connect Thinking. (2013, 03 27). Retrieved 03 25, 2018, from https://connectthinking.com.au/12-common-complaints-about-learning-management-systems-lms/

Hubwieser, P., & Böttcher, J. (2015). Personal Learning Environments in Future Learning Scenarios. Invited Keynote Talk. In A New Culture of Learning: Computing and next Generations. IFIP TC3 Working Conference (pp. 1-14). Lithuania: Vilnius University.

Hussey, J., & Hussey, R. (1997). Business Research.

JISC. (2008). Effective practice with e-portfolios. Retrieved March 20, 2018, from http;//www.jisc.ac.uk/eportfolio

Rasmussen, A. (2016, 10 13). Technology Advice. Retrieved 03 25, 2018, from https://technologyadvice.com/blog/human-resources/8-common-complaints-about-learning-management-systems/

Sekaran, U. (2009). Research Methods for Business: A Skill Building Approach. John Wiley & Sons.

Tam, M. (2002). University Impact on Student Growth: A quality measure? ournal of Higher Education Policy and Management,, 24(2), 211-218.

Wright, R. D. (2014). Student-Teacher Interaction in Online Learning Environments. Texas: IGI Global.

JBT

Journal of Business and Technology

International peer-reviewed journal | Publish semi-annually

Use of Solar Electricity: Is it a matter of standard of living? Evidence from Sri Lanka

C. N. Wickramasinghe[1], R. M. S. D. Bandara[2], and R. S. L. B. Ranasinghe[3]

[1 2 3] Faculty of Commerce and Management Studies, University of Kelaniya, Sri Lanka.
[*] Corresponding author: nalakacw1@yahoo.com

Abstract

In the fast-moving technological world, innovations such as Renewable Energy Sources available in the form of Solar Electricity have started playing a significant role in people's day-to-day lives. The impact of changes or expected changes in a given population's Standard of living as a reason for such a dramatic shift in electricity consumption is a field of interest that has not been thoroughly examined in the existing literature. Thus, the purpose of this study was to examine and assess the relationship between the Household shift to solar electricity and the Standard of Living, in an attempt to conclude statistically whether such a shift would be a matter of Standard of Living with regard to a developing nation in the South Asian region, namely, Sri Lanka. The research design has taken into consideration the Household size, Economic Status and the Standard of Living in relation to the two-folded sources of electricity used in Sri Lanka, Solar and Grid electricity. The study has based its roots on the existing literature in relation to the Developed countries carried out by Schelly in 2014. Statistical Package for Social Sciences (SPSS) was used to carry out investigations related to the aforementioned relationship and Chi-square values and Mann-Whitney U Test Values were used as statistical measurements to arrive at conclusions, respectively.

Keywords: *Electricity, Energy, Solar Power, Sri Lanka, Standard of Living*

Introduction

Adapting to renewable energy sources has been encouraged by Governments all over the world. The present and future economic and environmental benefits of the shift from non-renewable energy to renewable energy has been discussed to a great extent in the literature (Ellabban, Abu-Rub, & Blaabjerg, 2014). When society becomes economically developed, citizens tend to use more and more electrical and energy-consuming equipment and devices to make their life easy. This creates the demand for more and more energy consuming products from the industrial sector. This causality is clearly visible in developed countries, where they have high energy-consumption and high economic indicators at both industrial and household levels (Walker & Day, 2016, Nasreen & Anwar, 2014). In literature, energy consumption has been identified as one of the indicators of economic growth and standard of living in industrial countries(Walker & Day, 2016). The existing limited studies in developing countries also have recognized the electricity consumption at households as an enabler of a higher standard of living of the citizens (Niu, Jia, Ye, Dai, & Li, 2016). However, since the non-renewable energy sources used for generating electricity are expensive, electrification of nations has been a costly task that has created a high price for electricity in many developing countries. High electricity cost has a significant influence on the "freedom" of using electricity at the domestic level and therefore, it has been said that technical and financial

reformations are needed in developing countries to use more and more renewable energy sources for electricity generation (Niu et al., 2016).

During the last decade the significance of renewable energy sources has been taken off in developing countries. There are national and regional level discussions on assessing the economic and environmental benefits of using renewable energy sources (Tsoutsos, Frantzeskaki, & Gekas, 2005, Jamasb, 2006). There are published studies on the preferences and attitudes of local communities towards investments in renewable energy projects and their perception on the use of new energy technologies in their daily lives (Stigka, Paravantis, & Mihalakakou, 2014).

With the overwhelming growth of science and technology, a large number of household technological products were developed to make human life easier. Owing to the tempting nature of these new technologies, people are tempted to use them in the household, but the expensiveness of the electricity acts as one of the major barriers in developing countries that hinders the ability to go ahead with these technologies to improve the standard of living at the household level. Solar Power is one of the alternative energy sources that would reduce the household cost of electricity. However, there is hardly any study that has made an effort to investigate the association between solar PV electricity adaptation and standard of living in a developing country. Therefore, the existing knowledge on how solar power shift would associate with the standard of living in developing countries is not sufficient to understand the socio-psychological effects on solar power adaptation in developing countries. This paper aims to provide the results of a study conducted to identify the relationship between shift to renewable electricity and standard of living at household level in Sri Lanka, which is a lower middle income island nation located in South Asia and a country that has taken a proactive policy initiative called “Battle of Solar power” to encourage citizens to shift for solar power at household level.

Literature Review

Emergence of renewable energy dialog in developing countries

As per the evidence, economic development, industrialization and standard of living are inseparable elements of social development which are continuing to each other in a continuous cycle. Therefore, per capita electricity and energy consumption have been recognized as the appropriate indicators of the industrial development and standard of living of the western societies (Huenteler, Niebuhr, & Schmidt, 2016). Even though much attention has not been given, electricity and energy consumption have significantly influenced the recent economic growth and standard of living in developing countries as well (Kebede, Kagochi, & Jolly, 2010). As per the evidence, the current level of techno-industrial development achieved by the developing countries like China, India, Singapore or Vietnam is heavily crenelated with their energy consumption (Nasreen & Anwar, 2014).

In most developing countries, infrastructure development and operation of the electricity sector have become public service govern by the government institution. Hence, there are explicit inefficiencies, productivity issues and imbalance cost-benefit situations in the energy sector in these countries (Zhang, Parker, & Kirkpatrick, 2008). Apart from that, there are emerging threats where the fossil fuel would be depleted (Shafiee & Topal, 2009) and there are environmental concerns over other non-renewable sources of electricity (Sims, Rogner, & Gregory, 2003). Hence, there are ongoing discussions on findings the best alternative renewable and sustainable energy sources in both developed (Mai, Mulcahy, Hand, & Baldwin, 2014) and developing countries (Huenteler et al., 2016). Since there was a drastic increase in crude oil prices during the years 2008-2010, all the countries started to find alternative electricity sources, which are cost-effective and environmentally friendly. Especially the region like South Asia faced a serious threat from this oil crisis since they totally depend on imported fossil oil from other countries. Based on the research conducted on the rain,

temperature and sunlight patterns throughout the year, solar photovoltaic (PV) and solar thermal technologies have been identified as a viable source of energy in South Asian (Huenteler et al., 2016) and sub-saran African regions (Huenteler et al., 2016). Considering the global prospect, technological progress, and environmental effects, solar photovoltaic power generation has been recognized as the most viable solution for electricity generation in developing countries (Hosenuzzaman et al., 2015).

Battle for Solar Energy in Sri Lanka

One of the major reasons for high electricity cost in developing countries is the source of energy they use for electricity generation. Mostly the source of electricity has been the power plants run by the coal, fuel extracted by the crude oil deposited beneath the earth surface or power plants runs by hydro power. Sri Lanka is an island nation situated in South Asia. Electricity generation, transmission and distribution in Sri Lanka are mainly done by the Ceylon Electricity Board (CEB), which is a government institution and Lanka Electricity Company (LECO), which is a government-owned company. CEB uses three main sources of energy for electricity generation in Sri Lanka: Hydropower, Coal Power, Fossil fuel. Owning to the increasing demand for electricity beyond the generation capacities, electricity board is forced to buy electricity generated by the private sector those who run mini-hydro and wind power plants at small and medium scale. However, the charges for privately generated electricity costs are generally higher than the rates CEB and LECO charged from the end users. However, CEB is not allowed to charge simple cost-plus margin prices from the consumers as per the social protection policy of the government. Therefore, in order to avoid the cost imbalance, CEB transfers that additional cost to moderate to high-end electricity consumers. Owing to this issue, moderate to high-end electricity charges in Sri Lanka are ranked to be the highest rates in the region. Owing to the limitations in power generation capacities, increase of imported fossil fuel prices and environmental concerns, citizens are always encouraged to save electricity rather than using it with “freedom”. Since the demand and cost of electricity generation continually increasing, CEB and LECO time to time, increase their tariff accordingly (Athukorala & Wilson, 2010). Hence the electricity bill has become a significant proportion from the monthly household income, public pressure on electricity bill was started to creeping in Sri Lanka. CEB and the government of Sri Lanka encourage the citizens to electrify their households and businesses using solar power as an alternative source; however, so far solar powered electricity has been utilized in Sri Lanka as small-scale household and business-a level projects on voluntarily basis. There is overwhelming political interest in renewable energy in Sri Lanka and the government encouraged the private sector business entities to bring solar power technology to the country. At present, the Government of Sri Lanka, CEB and LECO with the partnership with the private sector are encouraging the electricity consumers to use more solar power through giving concessions. This programme is called the “Battle for Solar Energy” and it promotes the setting up of small solar power plants on the rooftops of households, religious places, hotels, commercial establishments and industries in Sri Lanka. Because of the above program, there is a huge trend of shifting towards solar power by domestic electricity users. It is expected that through this intervention to add 200 MW of solar power to the national grid by the year 2020 and 1000 MW by the year 2025 (Ministry of Power and Renewable Energy, 2016). As per the statistics of the Ceylon Electricity Board (CEB), by the end of year 2014 there were only 1,688 solar power users, but by the end of year 2016 solar power consumers have been increased to 5,029 and that was 198% growth with respect to the year 2014.

Currently, there are more than 200 registered solar power service providers in Sri Lankan promoting solar energy targeting 5,264,282 households all over the country(Department of Census and Statistics, 2013). Since all the households would not get the return on investment by converting to solar power, actual market for solar power is significantly lower than this(De Silva, Attanayaka, Hapuarachchi, Wijekoon, & Sumudith, 2013). Hence there is severe competition

among the solar power providers; there are large verity of marketing campaigns going on to encourage the public to install solar panels on their households and business entities. On the other hand, Sri Lankan government encourages citizens to install their own solar power plants at household and business premises by giving bank loans at low interest rates, buying back the generated power to the national grid at an attractive rate and educating the citizens on the benefits of green energy sources.

Why people use solar energy

As per the content analysis conducted by the researchers, it was observed that there are three (03) main themes in the solar power marketing campaigns: 1. solar power to reduce the electricity bill, 2. solar power as sustainable green energy, 3. solar power as investment option. With this awareness campaigns, electricity consumers purchase solar systems with several objectives. Many of them want to reduce their electricity bills and some of them expect to get additional income and environmental protection.

The cost of installation of solar panels has drastically declined in the last five years, but still, this initial investment is relatively very high for the majority of households. LECO and banks are providing low interest rate solar power bank loans for 5-7 years matching the current electricity bill of the household. In this approach, the household has to pay the loan installment equal to their current electricity bill for a period of 5-7 years. Therefore, in reality, until that period household would not get any monetary savings from that. Even the household install the solar system by their saved money, there is an opportunity cost similar to a bank loan. Since this cost of capital issue, most households are trying to install higher capacity than their existing electricity usage. By doing that they will be able to generate more units than they consume and get the net benefit each month. Hence at least 5-7 years of investment in solar power would not give substantial economic benefit for users.

As per the research conducted by Schelly (2014), that is to explore what motivates homeowners to adopt residential solar electric technology in the state of Wisconsin, it has been examined as to the relative of importance environmental motivations, economic considerations, and the demographic characteristics and network relations influencing the adoption and diffusion of innovations. According to the findings, environmental values have not been a concern on adoption. Economic benefits in the narrow sense of calculated return on investment or payback period is less important than the particular timing of economic events within a household. Interestingly, this study has found an interest in technical innovation and enjoyment of the technical aspects of energy systems as motives for solar power adoption. This study has indicated that there are some socio-psychological influences on solar power adaptation among households.

As per evidence available on the result of global warming, Sri Lanka is experiencing a climate shift where rain becomes heavy and lasts for shorted period and dry period become longer and much hotter throughout the country. Therefore, increased electricity consumption for cooling has become a necessity at the household level. However, owing to the energy saving mentality, households consume electricity at restricted economy mode without using fans, electrical items, and air conditioners even they are living in temperature at high 30 degrees in most parts of Sri Lanka throughout the year. Solar power would allow the households to generate more electricity than they are currently consuming and use the additional units to bringing in additional life technologies, which they have not been using before and improve their standard of living. This might be the major motivation for households to go for solar power, but this was not explicitly highlighted or promoted as a motivator. However, who are shifting for renewable electricity sources to improve their standard of living and how this shift would actually influence on standard of living at household level have not been comprehensively addressed in previous studies. Especially the present study aims to explain the differences in standard of living of households between those who are using

national grid electricity and renewable source like solar powered electricity in Sri Lanka.

Methodology

Research Design

With the adaptation of solar power generation at the household level, the population of Sri Lankan household electricity users has been divided into two sectors: solar users and Grid electricity users. The aim of the study was to identify the differences in standard of living between solar power uses and grid electricity users. Therefore, the present study is mainly designed as a comparative research with two independent samples representing two segments of the electrified household in Sri Lanka. With the adaptation of solar power generation at the household level, the population of Sri Lankan household electricity users has been divided into two sectors: solar users and Grid electricity users.

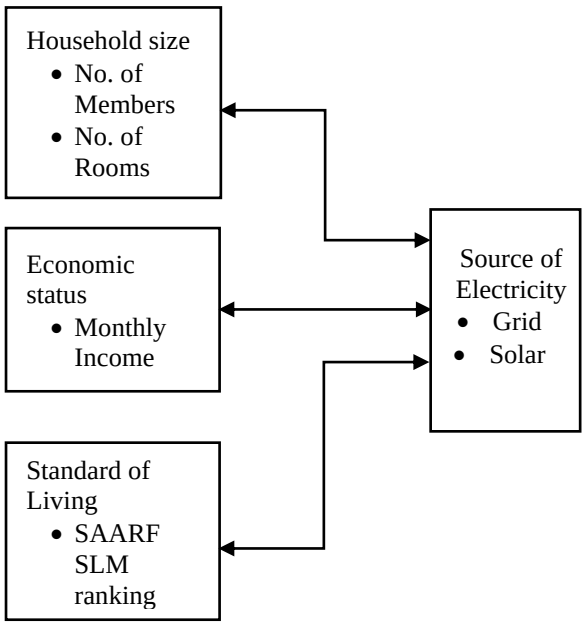


Figure 1: Conceptual Framework of the study

Operationalization

Household size

Household size has a positive impact on electricity consumption. When there are more rooms and members in the household, they tend to consume more electrical equipment and devices in their day-to-day life. Therefore, the number of members in a household and the number of rooms available in the household considered as indicators of the household size. As per the previous research findings, the researchers hypothesized positive associations between household size indicators and source of electricity.

Economic Status

Economic status often explains in relation to energy consumption. In the present study, the level of income has been used as the indicator of the economic status of the households (Rao & Pachauri, 2017). As per the findings of previous studies, high-income earners tend to consume more electricity than low-income earners. However, the conclusive evidence on the impact of income on shifting to solar power in developing countries are rare. Therefore, in the present study, the researchers hypothesized that there would be a significant association between level of income and source of electricity within the sample.

Standard of Living

The concept of Standard of Living has a long history in mankind and there are different definitions to define it. As per Sen (1984), there are at least three general approaches to the notion of the standard of living of a person. The first is to see the living standard as some notion of the welfare utility of a person, which describes the basic material things that person consumes in his/her normal life to satisfy their needs and wants (Sen, 1984). The second is some notion of opulence, wealth or income. The modern literature on real income indicators and the indexing of commodity bundles are stemming from this tradition of evaluating opulence. The third is to see the standard of living as one type of freedom; what is valued is the capability to live well, and in the specific economic context of standard of living, it values the capabilities associated with economic matters. The present study focuses on identifying the differences in standard of living between grid electricity users and solar

power users. Therefore, the concern is recognizing the differences in their consumption of devices and equipment that make satisfactory living at the household level. Therefore, the notion of standard of living in this study measured as the combination of first and second approaches described by Sen (1984).

Since the purpose of standard of living measurement is to segment the grid electricity users and solar power users with similar economic capacities on their standard of living, the Living Standard Measurement (LMS) developed by the South African Audience Research Foundation (SAAF) was adapted to measure standard of living. As per the latest LSM (2012), living standard has been identified through twenty-nine (29) objects used at households, all the objects in the scale were selected on logical grounds and it was developed through principle component analysis and stepwise regression analysis (SAARF, 2012). It categorized the households based on their standard of living into ten main categories from 1-10. Lower living standards have been divided into six categories and the next four higher living standard levels were categorized in to 3 subcategories (as 7, 7Low, 7High|8, 8Low, 8High|9, 9Low, 9high|and 10,10Low, 10High). In the present study, standard of living was measured by using the 29 indicators and weighting scale given by the SAARF LSM.

Electricity Consumption

In order to identify the changes in electricity consumption, they were asked to report their last three months' average electricity consumption levels based on the number of units reported in their electricity bills.

Population and Sample

With the latest statistics from CEB (by the end of the year 2016), there are 5,029 Solar Power consumers and 5,964,194 electricity consumers in Sri Lanka. Since the research was designed as comparative research, to apply inferential analysis, two random samples had to select with a sufficient number of households in each group. When deciding the sample size, G-Power sample size calculation tool was used and since the household size, Income and LSM were collected as ordinal variables, sample size required for non-parametric comparative analyses of Chi-Square (DF=4, Power=.80, CI=.05,ES=.3) and Mann Whitney U test (Two tail, Normal Parent distribution, ES=.5, Power -.80, N1:N2=1, CI=.05, were calculated (Faul, Erdfelder, Lang, & Buchner, 2007). For Chi-Square test, the required minimum sample size was 133 and for Mann Whitney U test it was 134 with 67 respondents for each group. Therefore, the researchers decided to use 140 (70 for each group) as the satisfactory sample size for this study.

When selecting the sample, first, the researchers stratified the grid users' population and solar users' population based on their electricity consumption as at the 1st January 2016. The researchers used this date, to avoid the influences of recent consumption changes into the sample selection process. Based on the CEB calculations, the number of units that can be generated by different solar plant sizes are available in the Sri Lankan market, where the majority of household users are Light users who consume 113-567 units per month and are using solar systems from 1KW-5KW. Since more than 90% of the households come under this category, the researchers identified that the light-usage strata as the target population of this study. Finally, among these two target populations, researchers randomly selected 70 solar power using households and 70 grid power using households from the CEB customer database in March 2017.

Data Collection

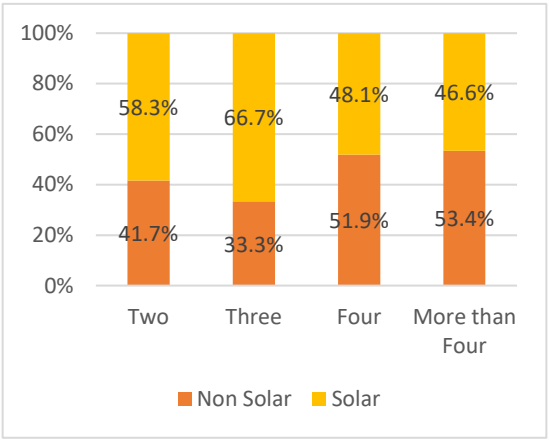
CEB is sending meter readers for each and every electrified household to get electricity meter readings every month. Irrespective of Solar power users or Grid power users, these meter readers are visiting each house. When selecting the sample, the researchers identified the exact households to be visited for data collection. The printed version of the questionnaire, including LSM and demographic information including Solar power usage (or not using) was given to selected meter readers and also provided them with comprehensive understanding about the research and what they have to get done.

During the first two weeks of March 2017, these enumerators visited selected households and gathered data required for the survey. Collected data were entered into SPSS software and verified for human errors and were verified by the researchers.

Findings

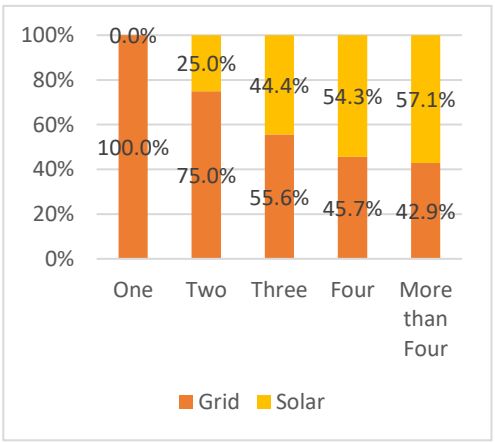
Solar Power Usage vs. Household size

In this study, household size was measured using two indicators: the number of permanent members in a household and the number of rooms available. According to the sample results, higher percentage of households with two to three members, have installed solar plants than the households with four or more than four members. However, the association between the number of members and source of electricity is not statistically significant. (χ2=2.657, Df=3, P=.448) (Figure 2).



$\chi 2$ =2.657, Df=3, P=.448

Figure 2: Percentage of Grid and Solar Electricity users by members of a household



FET=4.591,Df=4, P=.299

Figure 2: Percentage of Grid and Solar users by number of rooms in a household

Even though the Sample data has indicated households with more rooms tend to install solar power, the association between the number of rooms and source of electricity is not statistically significant (Fisher's Exact χ2=4.591, Df=4, P=.299) (Figure 3). Therefore, the conclusion is household size, both the number of members and the number of rooms do not have association with the decision to go for solar power generation at the household level.

Economic Status and Solar Power Usage

First, the researchers tested the sample data to check whether the distribution of income is the same across the grid power users and solar power users by using the Mann Whitney U Test. According to the test results at a 95% confidence level (P=.053) distribution of income is the same across the grid power users and solar power users.

Second, the researchers tested the association between income and source of electricity by using the Chi-square test of association. According to the crosstabs results, 2/3 of the households with less than SLRs. 75000 (US $ 500 or less) monthly income are using solar power. However, in relation to the Income level up to SLRs. 150,000-225,000, the percentage of solar power users in each income level has declined, where SLRs. 150,000-225,000 level 82% of households are using grid electricity. However, among the households with higher income levels, higher percentages are using solar power. The chi-square analysis results are illustrated in Figure 3, and there is a significant association between monthly income and source of electricity (X2=25.290, Df=4, P=.000) and as per the Cramer' V statistics (CV=.425, P=.000) the strength of the association is lower. This result indicates that even though

there is an association between income level and source of electricity, it might not be a linear association.

Standard of Living ratings of the households

The core aim of this study is to identify the association between standard of living and solar power usage. First, the researchers identify the categories of standard of living of the sample of all 140 households. Since they were selected from the target population identified based on the similar electricity consumption as at 1st January 2016, this analysis indicates the present level of standard of living of the households irrespective of their source of electricity. As per Figure 4, none of the households rate less than 6 ratings for the SLM scale. The minimum rating was 6 and only one household belongs to that rating. Highest percentage of households was in 10 Low categories and more than 17% of the households rated 10 Higher level. In general, more than 81% of the households rate 9 Low or above standard of living rating.

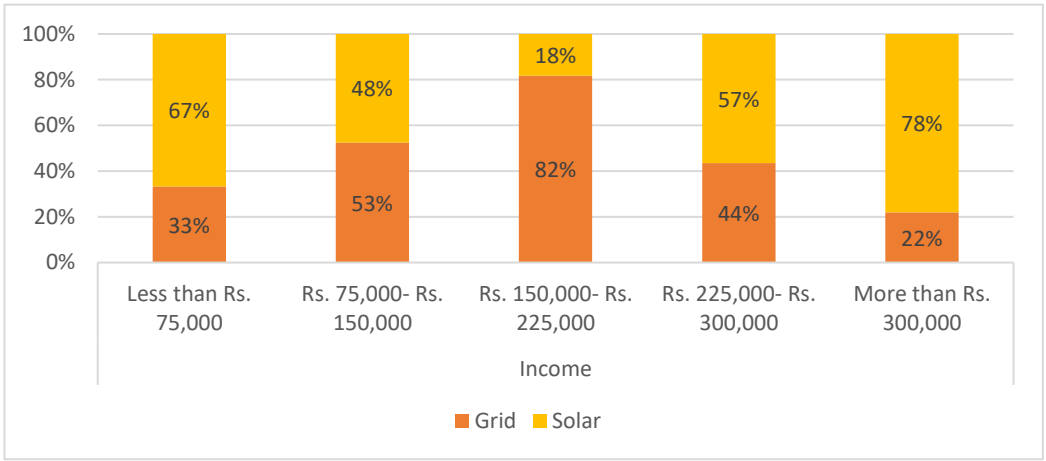


Figure 4: Percentage distribution of Source of Electricity by Income levels

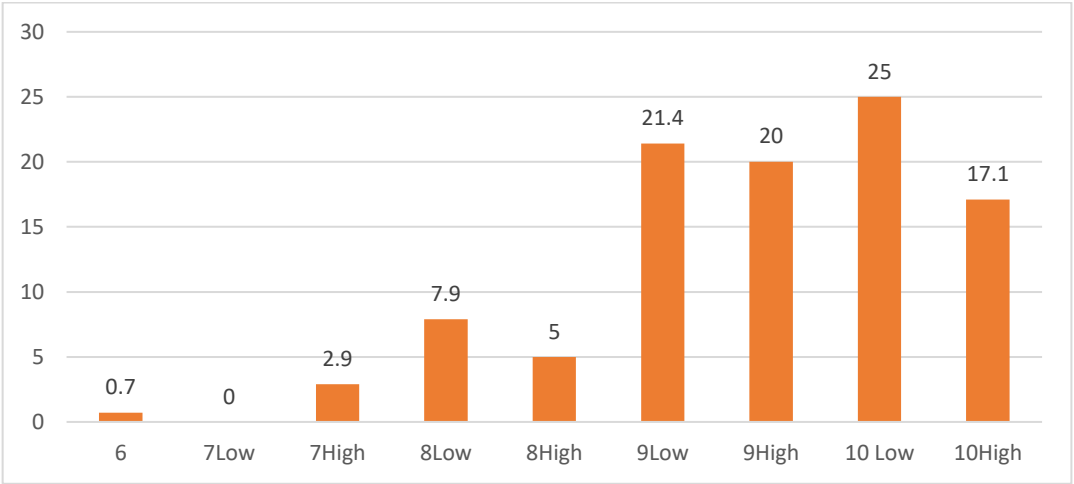


Figure 5: Ratings of the households in the sample by SAAF SLM levels

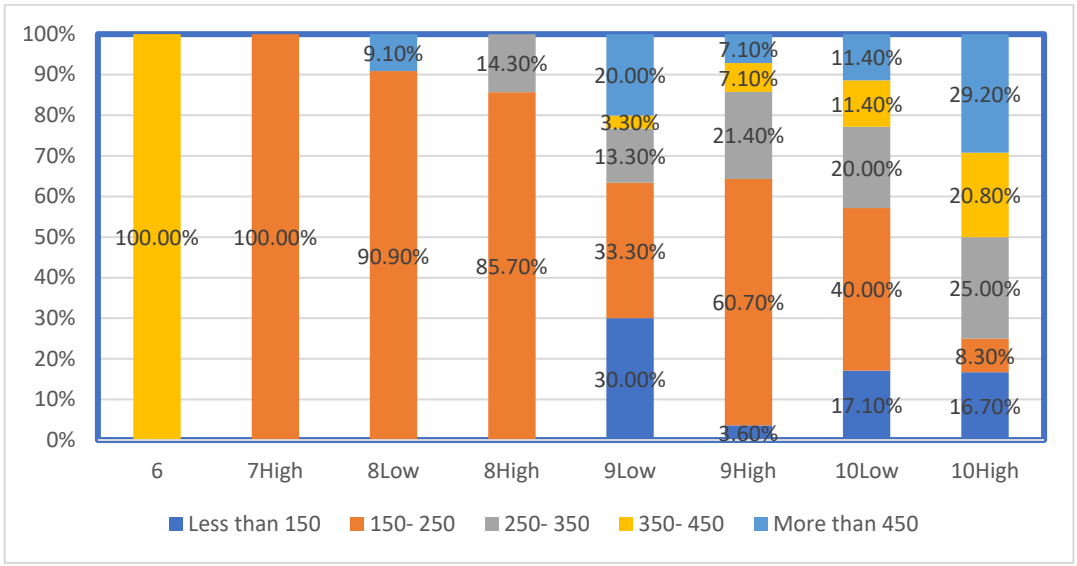
Standard of living and Electricity consumption

Standard of Living is a multidimensional facet and SAARF SLM covers 29 elements to calculate the standard of living rating. These 29 elements include 17 elements that relate to electrical equipment usage and 12 elements that are non-electrical elements (SAARF, 2012). Hence, the researchers hypothesized a significant association between standard of living and electricity consumption. According to the distribution of contingency table, 80% of cells have expected count less than 5, and the degrees of freedom was 28. Therefore, SPSS was unable to run the chi-square test using the respective method. Hence, the researchers used Monte Carlo exact method to run the chi-square test. According to the test results, there is a statistically significant association between Standard of Living rating and current electricity consumption (FET=40.211, P=.001). Whereas, the proportion of relatively low electricity consumption (Less than 250 units per month) has declined with the higher standard of living ratings, while the proportions of high level electricity consumptions increased among the households with high standard of living. The results indicated that, even though the sample was selected based on their 1st January 2016 electricity consumption, they have shown diverse levels of electricity consumption based on the improved standard of living.

Standard of Living and Solar electricity Usage

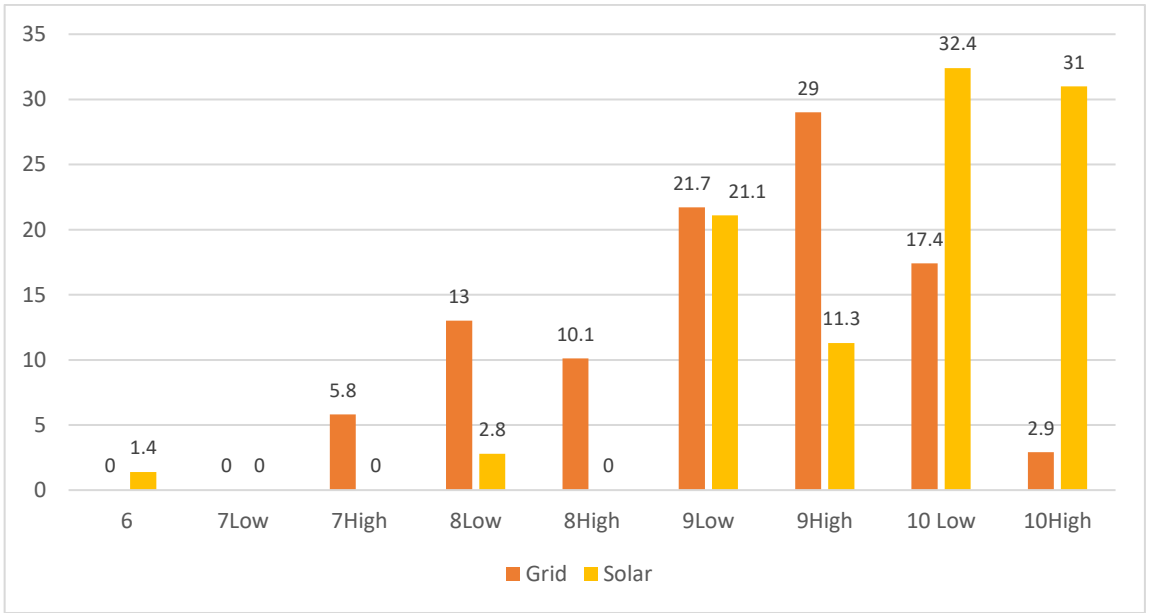
In order to explain whether there is an association between Standard of living and source of electricity, the Chi-square analysis was conducted. Results of the cross-tabulation data are presented in figure 5 and indicate that among the Solar power users, more than 63% are having 10 Low (32%) and 10 High (31%) ratings for standard of Living. Another 32% of solar panel users are having 9 Low (21%) and 9 High (11%) standard of living ratings. Only 4.2% of solar users ranked lower than 8 Low rating for their standard of living. In contrast, among grid electricity users, 28% of the households' rate 8High (10%) or lower Standard of living ranking and 67% rate between 9Low and 10Low categories. Only 2.9% of the households rate the highest standard of living rating, 10High.

Since the contingency table contained 37% of cells with an expected count of less than 5, Fisher's exact test chi-square value was used to test the significance of the association between standard of living and source of electricity. According to the test results, there is a statistically significant association between standard of living and source of electricity (FET=43.282, P=.000). The strength of the association indicates low to moderate level association (Cramers V= .546).



Fishers Exact Test =40.211, Moto Calo P=.001, Cramers V=.326

Figure 6: Percentage distribution of Standard of Living ranking by Electricity consumption



37% of the cells have expected count less than 5, therefore Fisher's exact test has been used
Fisher's Exact test $\chi 2$= 43.283, P =.000, Cramer's V=.546

Figure 7: Standard of living ratings of households by Source of electricity

Discussion

During the last decade, the significance of renewable energy sources has been taken into consideration in developing countries. There are national and regional level discussions on assessing the economic and environmental benefits of using renewable energy sources. Installation of Solar panels at the household level is the most popular renewable electricity source in Sri Lanka, which is a lower middle-income country in South Asia. Promotional campaigns for renewable energy sources mainly highlight the long-term cost savings for households and national level environmental benefits. As per limited studies in the field, environmental motivations, economic considerations, demographic characteristics and network relations influencing the adoption and diffusion of innovations have been hypothesized as the motivators for residential solar power usage (Schelly, 2014). Even though there are previous studies conducted to determine the relationship between economic status and standard of living (Apergis & Payne, 2009). Further, some attempts have been taken to determine the association between electricity consumption(irrespective of grid or solar) and standard of living in Asia(Niu et al., 2016). However, there is hardly any empirical study in the context of South Asia to demine the association of source of electricity on the standard of living. Therefore, the present study has filled the existing knowledge gap by explaining the positive association between standard of living and solar power as household electricity and also the positive association between monthly electricity consumption and solar power as household electricity.

Since the meaning of "saving" is reserving money for future consumption by foreseeing and expecting an increase of economic wealth through investment, economic growth would help improve the standard of living. Shifting from grid power to solar power is a high-cost long term investment. However, without waiting for the return on investments gained through the payback period, instantly solar power investment allows the household to improve their standard of living by directly transferring the energy cost saving to use more electricity that can make their lives easy. Therefore, apart from the cost savings aspect, investment in solar power actually generate a "psychological feeling of an additional income" for households to spend more on consumption. The significant association between high standard of living ratings and solar power usage suggests that, solar power has improved the "freedom" of life style choices among the households to invest the cost savings on electrical equipment make their lives easy.

There might be more than one reason why households shift from grid electricity to solar electricity. Most marketed reasons are environmental concerns and the need for reducing the electricity bill. However, none of these factors were significant motivators for residents to go for solar energy (Schelly, 2014). As per Schelly (2014) biasness toward robust technologies; they discussed their curiosity of innovative electricity technologies as a motivating factor influencing their decision to adopt solar. However, Schelly's study did not explore the consumption changes after adapting solar electricity at the household level. According to the findings of the present study, biasness of technology driven standard of living or need for increasing the standard of living by adopting state of the art technology equipment might be a major reason for household solar power usage in Sri Lanka. Owing to this technology bias, when getting used to solar power, households might change their priority towards standard of living rather than cost saving. Owing to the high electricity bill, households might not be able to use many of the electric equipment that they would want to use in the past. However, the installation of solar power allows the households to use more electrical equipment at low electricity bills.

The findings of the study have introduced another marketing dimension to Government, Solar power companies or any party those who are interested in encouraging households to move from grid electricity to solar electricity. The positive association between solar power usage and standard of living would be a great motivator to convince the citizens. As per current electricity

consumption patterns, the majority of the Sri Lankans are electricity light-users deepening on a subsidized tariff. Since this is not a sustainable strategy, CEB should encourage users to shift to solar energy while increasing their standard of living through making them consume electrical devices that make their lives easy.

The results of the present study indicate that there is no association between household sizes; either the number of members or the number of rooms available is significantly associated with the source of electricity. However, there is a significant association between economic wealth and source of electricity, where monthly income has a positive association with source of electricity usage where higher income earners tend to use solar power than grid electricity. Therefore, shifting from grid electricity to solar power might be high among the high-income categories. This trend might cause a problem for the Ceylon electricity board since according to their tariff system, high income earners are the ones who absorb the subsided low-income consumers electricity subsidy. Hence, the government has to make some strategic decisions to face serious challenges to generate enough income from grid electricity, in the likely case the high-income earners (high consumers) shift to solar power rapidly.

Conclusion

The findings of the present study indicate the glimpse of the association of socio-psychological dimension in the adaptation of renewable energy by the household sector in a developing country. Even though the general discussions and marketing efforts on promoting solar PV electricity at the household level often highlight environmental protection, cost savings and energy conservational habits, solar users tend to increase their electricity consumption by getting high standard of living in return. The findings of the present study align with the theoretical proposition presented by Schelly 2014, “Humans make decisions about technology adoption from within a social context shaped not only by environmental values or economic structures but also by a complex mixture of considerations regarding lifestyle choices”.

This study is one of the initial studies that attempted to identify the association between standard of living and solar power electricity. The present study has used SAARF LSM scale to measure the standard of living of the sample. Inherently the scale gives categorical outputs, which restricts the possibility of using nonparametric statistics to make the inference. Therefore, future researchers would be able to test the same hypotheses of this study using high-end parametric statistics. Furthermore, this study was not designed to identify the causal relationship between the solar power usage and standard of living. Future researchers would be able to conduct casual research to identify whether solar power usage influence on standard of living or standard of living influence on solar power usage.

Reference

Apergis, N., & Payne, J. E. (2009). Energy consumption and economic growth: Evidence from the Commonwealth of Independent States. Energy Economics, 31(5), 641–647. https://doi.org/10.1016/J.ENECO.2009.01.011

Athukorala, P. P. . W., & Wilson, C. (2010). Estimating short and long-term residential demand for electricity: New evidence from Sri Lanka. Energy Economics, 32, S34–S40. https://doi.org/10.1016/J.ENECO.2009.08.005

De Silva, M. T. K., Attanayaka, T. L. B., Hapuarachchi, D. C., Wijekoon, R. B., & Sumudith, B. G. D. L. (2013). Long Term Generation Expansion Planning Studies. Retrieved from http://www.pucsl.gov.lk/english/wp-content/uploads/2013/11/LTGEP 2013-2032.pdf

Department of Census and Statistics. (2013). Principle Sources of Lighting in Sri Lanka. Retrieved January 11, 2018, from http://www.statistics.gov.lk/PopHouSat/CPH2012Visualization/htdocs/index.php?u

secase=indicator&action=Data&indId=600

Ellabban, O., Abu-Rub, H., & Blaabjerg, F. (2014). Renewable energy resources: Current status, future prospects and their enabling technology. Renewable and Sustainable Energy Reviews, 39, 748–764. https://doi.org/10.1016/J.RSER.2014.07.113

Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. Behavior Research Methods, 39(2), 175–191. https://doi.org/10.3758/BF03193146

Hosenuzzaman, M., Rahim, N. A., Selvaraj, J., Hasanuzzaman, M., Malek, A. B. M. A., & Nahar, A. (2015). Global prospects, progress, policies, and environmental impact of solar photovoltaic power generation. Renewable and Sustainable Energy Reviews, 41, 284–297. https://doi.org/10.1016/J.RSER.2014.08.046

Huenteler, J., Niebuhr, C., & Schmidt, T. S. (2016). The effect of local and global learning on the cost of renewable energy in developing countries. Journal of Cleaner Production, 128, 6–21. https://doi.org/10.1016/J.JCLEPRO.2014.06.056

Jamasb, T. (2006). Between the state and market: Electricity sector reform in developing countries. Utilities Policy, 14(1), 14–30. https://doi.org/10.1016/J.JUP.2004.11.001

Kebede, E., Kagochi, J., & Jolly, C. M. (2010). Energy consumption and economic development in Sub-Sahara Africa. Energy Economics, 32(3), 532–537. https://doi.org/10.1016/J.ENECO.2010.02.003

Mai, T., Mulcahy, D., Hand, M. M., & Baldwin, S. F. (2014). Envisioning a renewable electricity future for the United States. Energy, 65, 374–386. https://doi.org/10.1016/J.ENERGY.2013.11.029

Ministry of Power and Renewable Energy. (2016). Battle for Solar Energy. Retrieved January 9, 2018, from http://powermin.gov.lk/bfse/

Nasreen, S., & Anwar, S. (2014). Causal relationship between trade openness, economic growth and energy consumption: A panel data analysis of Asian countries. Energy Policy, 69, 82–91. https://doi.org/10.1016/J.ENPOL.2014.02.009

Niu, S., Jia, Y., Ye, L., Dai, R., & Li, N. (2016). Survey data on household electricity consumption and living status in Northwestern China. Data in Brief, 7, 1106–11. https://doi.org/10.1016/j.dib.2016.03.093

Rao, N. D., & Pachauri, S. (2017). Energy access and living standards: some observations on recent trends. Environmental Research Letters, 12(2), 25011. https://doi.org/10.1088/1748-9326/aa5b0d

SAARF. (2012). Living Standard Measure. Retrieved January 10, 2018, from http://www.saarf.co.za/lsm/lsms.asp

Schelly, C. (2014). Residential solar electricity adoption: What motivates, and what matters? A case study of early adopters. Energy Research & Social Science, 2, 183–191. https://doi.org/10.1016/j.erss.2014.01.001

Sen, A. (1984). THE LIVING STANDARD, 36, 74–90. Retrieved from http://www.jstor.org/stable/2662838

Shafiee, S., & Topal, E. (2009). When will fossil fuel reserves be diminished? Energy Policy, 37(1), 181–189. https://doi.org/10.1016/J.ENPOL.2008.08.016

Sims, R. E. H., Rogner, H.-H., & Gregory, K. (2003). Carbon emission and mitigation cost comparisons between fossil fuel, nuclear and renewable energy resources for electricity generation. Energy Policy, 31(13), 1315–1326. https://doi.org/10.1016/S0301-4215(02)00192-1

Stigka, E. K., Paravantis, J. A., & Mihalakakou, G. K. (2014). Social acceptance of renewable energy sources: A review of contingent valuation applications. Renewable and Sustainable

Energy Reviews, 32, 100–106. https://doi.org/10.1016/J.RSER.2013.12.026

Tsoutsos, T., Frantzeskaki, N., & Gekas, V. (2005). Environmental impacts from the solar energy technologies. Energy Policy, 33(3), 289–296. https://doi.org/10.1016/S0301-4215(03)00241-6

Walker, G., & Day, R. (2016). Necessary energy uses and a minimum standard of living in the United Kingdom: Energy justice or escalating expectations? Energy Research & Social Science, 18, 129–138. https://doi.org/10.1016/J.ERSS.2016.02.007

Zhang, Y.-F., Parker, D., & Kirkpatrick, C. (2008). Electricity sector reform in developing countries: an econometric assessment of the effects of privatization, competition and regulation. Journal of Regulatory Economics, 33(2), 159–178. https://doi.org/10.1007/s11149-007-9039-7

Journal of Business and Technology,

Department of Commerce and Financial Management, University of Kelaniya, Sri Lanka.

Guidelines for Authors

Journal of Business and Technology is an international journal which is published semi-annually is the refereed journal of the Department of Commerce and Financial Management. The vision of the journal is to offer an academic platform to researchers to publish their novel, empirical and high-quality research work at national and international level. It proposes to encourage research connecting to modern trends and practices in finance, entrepreneurship, human resource management, marketing and emerging paradigms in related areas of management including social sciences, education and information & technology.

Types of Manuscripts Accepted and Word Limit

Research Paper (Empirical or Conceptual): 8000 to 10000 words

Case Study: 6000 to 8000 words.

Submission

All manuscripts considered for submission should be directly mailed to the to the JBT's official mail; jbt@kln.ac.lk.

Formatting Guidelines

Manuscripts should be in English and typed in Times New Roman font size 10, with single line spacing in double column (except the abstract) and with a 1-inch margin on all sides. The size of the page should be B5. The body of the manuscript may arrange under the headings of Introduction, Literature Review, Research Methods, Findings and Discussion followed by the Conclusion and Future Research Directions.

Author/s Name and Affiliation

Name: Name with Initial, Times New Roman, 11-point

Affiliation: Department, Faculty, University/ Institution, Country, Times New Roman, 10-point

Email: Times New Roman, 10

Should name the corresponding author

Manuscript Title: The title of the paper should be in 12-point Times New Roman font. It should be bold typed.

Abstract: Following the cover page, there should be an 'Abstract' page, which should contain the title of the paper, the subtitle 'Abstract' and a summary of the paper in single space, not exceeding 200 words in single column. The text of the paper should not start on this page, but on a fresh page with the title of the paper repeated.

Keywords: Abstract must be followed by a list of keywords, subject to a minimum of three. These should be arranged in alphabetical order and be separated by commas with a full stop at the end.

The body of Manuscript: Manuscript must be prepared on standard B5 size paper setting. It must be prepared on a single spacing and double column with a 1-inch margin set for top, bottom, left and right. It should be typed in 10-point Times New Roman font with page numbers at the bottom centre of every page.

Headings: All section headings should be in 11-point Times New Roman font, and sub-section headings should be in 11-point Times New Roman font. These must be bold-faced, aligned left and fully capitalized. Leave a blank line before each heading.

Table and Figure: Table and figure caption should be left aligned and numbered, 10-point. Source should be aligned left and below the table and figure, 10-point, italic. Do not use coloured tables or figures.

In-text Citations: Indicate the position of the reference in the text within brackets by the author's last name and the year of publication; e.g.: '(Rae 2007)' or incorporate it into a sentence, e.g.: 'as pointed out by Rae (2007)'.

References: References should be in the APA style.

Notes: Do not use footnotes. Minimize endnotes. If they are unavoidable, number them serially in the text using superscript and list them together on a separate sheet under the heading NOTES immediately following the text of the paper. Notes are not for citing a reference but for offering a significant explanation, which is important for understanding the text but is tangential to the main idea discussed therein.

Revised Manuscripts: At the end of the review process, the author is expected to incorporate the modifications suggested by the reviewers, if any, and submit a soft copy of the final revised manuscript.

Contacts Journal of Business and Technology

Editor in Chief
Department of Commerce and Financial Management, University of Kelaniya, Sri Lanka
Tel: +94 112914485
Email: jbt@kln.ac.lk

Department of Commerce and Financial Management
Faculty of Commerce and Management Studies
University of Kelaniya
Sri Lanka