Adaptation of Green Value Chain Strategy in Industry Sustainability of the Cement Manufacturing Sector of Sri Lanka.

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Contents

ABSTRACT

There are some industrial sector companies operate in Sri Lanka implemented green business practices to get competitive edges. The sustainability of a business is one of the holistic outcomes expected out of green value chain practices. However, knowledge gaps and practse issues are found within the Sri Lankan context to examine the effectiveness of green value chain in overall. Alongside, this study examined the impact of the green value chain strategy on the sustainability of the Cement Manufacturing Sector of Sri Lanka addressing to industry related issues and empirical gaps. The main research questions were developed in line with empirical and practice-related research gaps. Environmental innovativeness was also examined within the main variables to address empirical research gaps supported by industry-related justifications. According to the research questions developed, four hypotheses were tested after collecting the data through a survey of 104 respondents since the study population is very less in numbers. The key objectives were to examine the interrelationship between the Green Value Chain Adaptation on innovation and sustainable performance, while mediating effect of environmental innovation was also tested. The study used a deductive approach to conduct the study supported by quantitative research strategy.

Researched developed the research model and Structural Equation Model (SEM) was used to test the relationships and impacts on path analusis by using AMOS-23 softwear. Results proved that green value chain adaptation impacts on sustainable performance, and the mediating effect of environmental innovation was also verified. Descrpitive analysis was carried out to explaine the behaviour of main variables for managerial implications. Researcher produced the conclusion supported by managerial implications for the green business practices for cement industry in Sri Lanka.

Keywords: *Cement Industry, Environmental Innovation, Green Value Chain Adaptation, Sri Lanka, Sustainable Performance*

CHAPTER I INTRODUCTION

1.1 Background of the Study

The challenges of operating sustainable businesses in the 22nd century have become more difficult than in any previous decade. Due to increasing levels of competition, stakeholders are empowered to have a significant impact on the operation of a business, especially on critical issues that have environmental concerns. Zhang (2016) reported that some companies understand this paradigm and are taking action to reduce their carbon footprint with stakeholder management. In the wake of environmental concerns and the need to reduce carbon footprint in manufacturing companies now practice novel methods by making changes in the value chain to be more environmentally responsible (Chen & Shih, 2007 and Zhu *et al.,* 2005).

The manufacturing industry is a conversion of raw material through a production process that reserves a product offered at a specific value given to the consumer (Feller *et al.,* 2006). Organizations involved in manufacturing operations generally tend to impact the environment through the conversion process. Typical environmental impacts range from noise pollution, Deforestation, carbon emission, and chemical and other forms of waste that are considered a by-product of the manufacturing process (Lau *et al.,* 2008). The cement industry is considered an essential business industry in the world today. As it is a primary component in building construction and masonry applications, the demand for the product directly correlates to the growth of these types of projects worldwide (Zhang *et al.,* 2015). Current cement manufacturing is approx. 4.1 Billon tones globally (Zhang *et al.,* 2015). Green value creation through the green value chain is explained as the adaptation of cleaner production systems and value-creating activities of an organization for sustainability (Chen & Shih, 2007; Vanany *et al.,* 2009). According to Chen and Shin (2007), the green value chain results in a significant reduction in costs of material purchased, energy consumed, and waste Population and Samples: According to Chen and Shih (2007), and Dawes (2009), the population of interest generated, avoidance of fines due to violation against manufacturing regulations whilst generating foundation for sustainable results including financial performances thus, most of the companies apply ISO14001 into their value chain, functions to get sustainable performances and competitive advantages (Markley *et al.,*2015).

However, the cement industry has a considerable carbon footprint on the environment, primarily as carbon dioxide emission is a by-product of the cement manufacturing process. As it is a direct result of the manufacturing process's chemical reaction, this cannot be eradicated

totally (Vanani *et al.*, 2009). Harland (2016) stated that by 2050 cement manufacturing plants in the UK will produce approximately 5 million tons of carbon dioxide, over 20 times more than projected figures by the government. The greenhouse gas effect has become a prevalent topic among several social interest groups in today's society (Worrell *et al.*, 2001). These interest groups have had a significant impact in creating awareness resulting in primary stakeholders such as regulatory authorities, customers and shareholders insisting on more responsible manufacturing processes to reduce the environmental impact (Chien & Shih, 2007). The cement industry's environmental impact has resulted in pressure on comments created by stakeholders. Therefore, the manufacturer has to take steps to reduce the carbon emissions the challengeable industry itself in terms of its value chain activities reengineering for its sustainability to reduce the impact on the environment (Rimmele *et al.,* 2008).

Meanwhile, the value chain introduced by Porter (1985) and modified by McKinsey consist of activities that make up the conversion process from base raw materials to final product delivery to the customer. Decker (2003) defined the value chain as the horizontal linked set of value-creating activities the commence from the basic component raw materials to the finished produce delivered to the customer for use. The premise of the value chain has been to perform these activities as efficiently as possible to drive profit margins for shareholders and deliver a valuable product to the customer while meeting all stakeholder expectations.

The Adaptation of green value creation through the value chain strategy has been discussed in line with the green value chain since most of the supply chain management functions directly connect with the value chain functions strategy (Chen & Shih, 2007). Thus, industries like cement manufacturing are also found as a critically important sector to contribute to sustainability via the green value chain as an explanation of the green value chain process. (Dawes, *et al., 2015*; Knight & Jenkins, 2009; Tan & Zailani, 2009; Zhang *et al.*, 2015). Empirical gaps are found claiming to investigate the effectiveness of such green value creation activities initiated by firms through their value chines, including the cement manufacturing sector as one of the key sectors (Dawes *et al.*,2015; Knight and Jenkins,2009; Rao & Holt, 2005; Tan *et al.*, 2002; Tan and Zailani, 2009; Zhang et al. 2015). However, it is established that current industry stakeholder expectations go beyond simply earning profit and value-adding. It must now be intergraded with the essential commitment to “Go Green” in value base activities. Today’s business context requires organizations to be more responsible in the manufacturing processes beyond the point of merely generating profit margin (Dawes, 2009;

Knight and Jenkins, 2009; Zhang *et al.,* 2015). The research will identify that stakeholder expectations are represented more accurately through green value chain concepts which will indicate the need for the modification of the classic value chain model. This study also focuses on the mediating factor of environmental innovation and its impact on the "Adaptation of Green Value Chain strategy impact on the firm sustainable operations". Environmental innovation is defined as manufacturing practices that focus on the efficient use of raw materials, converting waste into sellable products and pollution prevention through the use of our environmental management system (Porter &Van der Linde, 1996).

1.1.1 Context of the Study

These are significant areas that remain unanswered in the local cement industry due to the lack of research in the area. Usually industrial sector brands and business models in Sri Lanka find empirical research insights referring to branding, consumer responses and the business value processes being applied (Munasinghe and Dissanayake, 2018). Sustainability related value practices are found in Sri Lankan industrial sector firms including cement industry but require serious attention to enhance it. While global activism continues to play a large part in controlling the carbon emissions done by the cement industry, local cement manufacturers now begin to feel the pressure at several environmental legislations governing the emission of carbon dioxide are being implemented not only to the industry level but even at the level of the consumer . The recent legislation passed 4 years ago was a revolutionary implementation that required the mandatory testing of automobile carbon emission rates prior to obtaining a revenue license. This legislation has been implemented to reduce the number of vehicles which emit high levels of carbon dioxide Sri Lanka.

The globalized age has seen the intensified competition, rapid technological developments and increased product complexity, all of which created the need for improvements to be made in businesses' ongoing green value chain policies (Dawes,2009; Tan and Zailani, 2009; Knight and Jenkins,2009). One of the many applications developed to cater for this necessity is the green value chain, which is the re-structuring and enrichment of conventional green value chain management through incorporating environmentally conscious methods into the links of this chain (Rao & Holt, 2005; Tan *et al.,* 2002; Zhang *et al.,* 2015). Academic literature contains various studies regarding the green value chain, resulting in various definitions. The green value chain is the re-evaluation of the innovations in the green value chain management and industrial procurement through an environmental perspective (Green *et al.,* 2012). The green

value chain consists of substituting procurement activities with recycling, reusing and substituting materials (Narasimhan and Carter, 1998). The green value chain monitors and improves a business's environmental performance. The green value chain integrates certain transactions like product design, delivery, raw material selection, and waste management with a green value chain by considering environmental considerations (Srivastava, 2007). Even though plenty of definitions have been presented in the literature, nearly all studies agree that combining environmental awareness with effective green value chain management incorporates the concept. A green value chain's main objective is to ensure that businesses take environmental concerns into account while making progress in their green value chains (Rao and Holt, 2005; Tan *et al.*, 2002; Zhang *et al.*, 2015). Through this environmental consciousness, it is being aimed that environmentally risky processes are eliminated from the green value chain, thus enhancing the businesses' environmental effectiveness and mitigating their environmental risks while simultaneously helping increase their profitability and market share. (Creswell, 2014; Revilla & Knoppen, 2015; Skilton, 2014; Spring & Araujo, 2014; Zhang *et al.*, 2016).

The ever-increasing importance of the green value chain management mainly stems from diminished raw material sources, saturation of dump sites and rise in pollution. Rising trading/transaction volumes both domestically and internationally have forced businesses to acknowledge that self-management of operations is not sufficient for high performance. Therefore, they have started to strengthen the applications that integrate the backward processes comprising of businesses supplying the raw materials as well as the forward ones including processes that involve the delivery of the products to the end user and after-sales transactions (Handfield & Nicholas Jr, 2004). Businesses prefer this method to effectively control pre and post-production processes, therefore enhancing the maneuvering space for taking effective and systematic actions (Creswell, 2014; Revilla & Knoppen, 2015; Skilton, 2014). Moreover, the recent ages have seen businesses comprise of many functions and evolve into multi-structured entities, contributing to their aim to unify and manage all these functions under one encompassing roof. Therefore, the notion of a green value chain has arisen from the need to form and transparently monitor a structure where all components are interconnected through a single network (Creswell, 2014; Revilla & Knoppen, 2015; Skilton, 2014; Spring & Araujo, 2014; Zhang *et al.*, 2016).

Green value chain management aims to cater to rising consumer demand and boost competitive advantage (Revilla & Knoppen, 2015; Skilton, 2014; Spring & Araujo, 2014; Zhang *et al.*, 2016; Chen & Shih, 2007). Recently, businesses have adopted the green value chain via integrating conventional green value chain methods with environmental consciousness to comply with legislation, transform their businesses to be environmentally friendly and ensure customer satisfaction. In contrast to the classical green value chain management, the green value chain method requires that actions such as procurement, shipping, and production are taken from an environmental point of view (Revilla & Knoppen, 2015; Skilton, 2014; Spring & Araujo, 2014; Zhang *et al.,* 2016). Businesses should pay utmost attention to developing safe and reliable products, prefer more environmentally friendly production phases/lines, reduce toxic wastes, develop environmentally friendly packaging methods and act with a specific environmental awareness (Shrivastava, 1993). While phases that require relatively more managerial scope than technical expertise like logistics and procurement are focused upon during the first few years following the emergence of the green value chain, reverse logistics, through the environmental perspective, has integrated with logistics and marketing in the later periods (Sarkis *et al.,* 2011).

Advantages of the green value chain can be classified into three parts: legal, social and commercial. Businesses implementing the green value chain can more easily comply with environmental laws, minimizing the potential compliance risks. On the social side, decreased energy consumption, waste production, emissions, environmental thread risks, raw material consumption, noise and radiation and risky material consumption contribute to improving employee and community health (Harland, 1996). In addition to all these, commercial benefits of the green value chain include increased market access, improved environmental performance, higher customer satisfaction and confidence, improved brand value and reputation, higher product and service quality, increased competitive advantage and market share, accelerated technological development and increased performance (Zhang *et al.*, 2016). Moreover, trading/transaction, energy, material, disposal and storage costs are reduced. Despite all these advantages, the green value chain requires significant capital expenditures to be undertaken and a highly-skilled R&D department to be formed, causing significant economic difficulties for small and medium enterprises upon the decision to undertake the green value chain. The drawback of the green value chain is the hike in raw material costs, testing costs, investment expenditures as well as the time spent conducting research and

development (Creswell, 2014; Revilla & Knoppen, 2015; Skilton, 2014; Spring & Araujo, 2014; Zhang *et al.*, 2016).

The green value chain is an integrated formation comprising of multi sub-systems. For its practical application, these sub-systems and their components must be understood in depth and implemented successfully. Major root causes for a successful green value chain are green procurement, green manufacturing, green distribution, green packaging and reverse logistics (Dawes, 2009; Knight & Jenkins, 2009; Zhang *et al.*, 2015). Green procurement involves "purchasing involvement in activities that include the reduction, reuse and recycling of materials" (Carter & Ellram, 1998). Green procurement is the procurement of environmentally-friendly materials that are either recyclable or have already been recycled (Sarkis, 2003). Businesses implementing the green value chain by conducting market research constantly to pursue and improve green procurement strategies and aim to increase the maturity and competency of the business in selecting environmentally-friendly raw materials/inputs. Green manufacturing is conducting manufacturing processes by considering environmental factors and re-designing and implementing those through ecological and environmental perspectives. This manufacturing method also encompasses retrieving used products and re-launching those after being put through specific processes (Dawes, 2009; Knight & Jenkins, 2009; Zhang *et al.*, 2015). Green manufacturing ensures that inputs/ raw materials utilization and damages/ threads incurred in the environment are minimized by ensuring that products are recyclable and reusable. Green distribution aims to identify and utilize shorter routes, reduce storage space/area and avoid holding unnecessary inventory. Distribution and transportation practices are the main factors triggering dangerous gas emissions and carbon dioxide particles within the green value chain (Paksoy *et al.*, 2011).

Moreover, as vehicles and types of combustibles utilized in distribution also bear critical importance, utilizing railways instead of highways could incur economic benefits for businesses and create positive environmental externalities. Transportation/transmission of products in large bulks, utilization of noise inhibiting devices in vehicles, usage of environmentally friendly vehicles and effective vehicle routing are crucial in implementing and maintaining efficient green distribution (Knight & Jenkins, 2009). **Green packaging** is an eco-friendly and environmentally-conscious packaging that ensures recyclability and reusability and supports sustainable development. It is a method of packaging that supports recyclability and reusability and does not create negative externalities such as pollution or threads on

community health (Zhang & Zhao, 2022). Process and product resignation to better enable recycling, cost reduction, enhanced utilization of environmentally-friendly materials and avoidance of petroleum-based plastics usage could be the main objectives of undertaking green packaging. Reverse logistics is the systematic acceptance process of products and parts that have previously been sent from consumption points for re-manufacturing or disposal (Dowlatshahi, 2000). Reverse logistics re-design green value chain to manage re-manufacturing, recycling/refurbishing and product/material flow. Reverse logistics management is examined in six parts: acceptance, reuptake, revision, renewal, transportation and re-engineering (Fleischmann *et al.*, 1997).

In early 1960, the Sri Lankan cement corporation, a government-owned entity, was the first fully integrated manufacturing cement plant in Sri Lanka. The company established their manufacturing plant in the northern province of Sri Lanka in the town of Kankesanthurai under "Kankesan Cement". Also, the company established two other cement manufacturing plants in Puttalam and Galle districts Within the next ten years which operated under the brand name of Sanstha" under the sole ownership of the Sri Lanka cement corporation. The private sector entered the market in 1982 when Sri Lanka opened its doors to the first Japanese-based manufacturer in Sri Lanka, TOKYO super cement Lanka Limited, a semi-integrated cement manufacturing plant established in the town of Trincomalee (Perera *et al.*, 2020).

In 1983, the government privatized the cement operating point in Galle under the company name Yashoda Enterprises Pvt. Ltd that manufactured products under the brand name of Ruhunu Cement. The civil unrest that shook the nation for nearly 30 years and security concerns made it impossible for the local government to operate the cement plants in Kankasanthure and Puttalam. As a result, the cement plants were closed in 1996 due to civil unrest. Holcim was the second manufacturer to enter the market; in 1996 entered the local market by acquiring the Puttalam cement plant from the government. As Holcim was an international brand, they had no issues operating in areas consistent with civil unrest as the private organization did not have any political or ethnic lenience. Due to its enormous success, Holcim acquired the manufacturing plant in Galle and continued to corporate on the same brand name, "Sanstha." Tokyo Cement Lanka Limited and Holcim cement are the only local manufacturers currently producing cement in Sri Lanka (LafargeHolcim,2017). Research conducted by the JKSB indicated that Sri Lanka's cement consumption was approximately 4.2 million tons per year in 2010, of which the cement production of Holcim was 1.4 million tons

of cement manufactured by Holcim and Tokyo cement manufacture near 2.4 million tons. Tokyo Cement has considered the market leader holding on to nearly 30% of the market share as of 2014, and is currently selling its products under the brand name Tokyo super. Holcim Controls about 20% of the market share, with another three retailers attributing for the balance 38% share with an overall 12% attributed to direct imports (Tokyo Cement, 2021).

Meanwhile, Holcim and Tokyo are the only two full-service manufacturers who conduct operations from limestone mining to packaging cement in bags for distribution; ultra-tech Lafarge and Singha bulk import cement and clinker that is processed and re-packed for distribution along the country. Overall, the comprehensive supply chain management strategies, innovative sustainable business practices and community marketing activities create value in the Sri Lankan cement manufacturing sector. However, there are limited empirical studies to reveal the outcome of those practices as it usually seemed in industrial sector organizations (Central Environment Authority of Sri Lanka –CEASL, 2017; Munasinghe & Dissanayake, 2018).

1.2 Research Problem

The study's centric research problem is based on the rationales mentioned below, which emphasize the research gap encoded within the centric essence of the research topic.

1.2.1 Theoretical Gap

According to the theoretical gap, it has claimed to examine the Adaptation of Green Value Chain strategy as a required research area in many industries, including industrial sector companies like cement manufacturing firms. In addition, empirical support is found claiming the need to investigate the relationship between Green Value Chain and sustainability in different aspects. Further, some studies argue that environmental innovation is a mechanism or system that firms need to initiate to result in sustainability which is not yet thoroughly investigated. Finally, it is claimed that there is a practice gap in Sri Lankan industrial sector and the leading cement manufacturing companies need to investigate effective strategies for sustainable performance. The effectiveness of green practices is to be revisited. Alongside, this study claims its research problem statement as “what is the impact of Green Value Chain practices on sustainable performances of cement industry in Sri Lanka whilst examining the mediating effect of green innovation”.

Cooperation of companies with vendors and suppliers for environmental purposes and the green value chain interactions for improving environmental performance impact the process significantly (Theyel, 2006). Companies can improve their environmental performance with the help of vendors and suppliers by setting standards and sharing resources. Insufficient environmental awareness of vendors/suppliers: The green value chain practices are not known for their economic and environmental benefits and may be a significant cause of resistance to the process (Ravi & Shankar, 2005). Thus, especially vendors and suppliers must be informed about the process. The complexity of assessing and monitoring vendors'/suppliers' environmental applications: The operation and implementation of the green value applications compose a complex process, which is a significant obstacle to the process (Hervani *et al.*, 2005). However, once the system has been developed, the application can be more widespread and accessible.

The initial theory of value chain (Chien & Shih, 2007) explains the integration of primary and secondary activities whilst each activity category is segmented (Porter, 1985). However, there are practice issues in the initial value chain model specified by Porter (1985) when organizations refine or revitalize their business process-related activities in line with sustainable applications. For instance, manufacturing sector companies need to synergize the green value chain activities for sustainable gains mentioned in financial, environmental and social performances (Kannan & Tan, 2005). However, the entire value chain model does not explain those in detail but mainly focuses on the margin, which is more related to financial perception. Moreover, the new trend of applying green value chain activities reflects fully in the generic model. Some of the activities claimed as non-value adding may be value-adding activities for sustainability-related business value operations (Rabelo *et al.*, 2007). Value chain has to be theoretically supported by mentioning the activities, coordination and outcomes mentioned in the initial value chain model (Porter, 1985). A theoretical gap has been found when the green value chain activities are compared with the most accepted value chain model explained by Porter (1985). Thus, studies need to reinvestigate the green value chain operations and how to recognize the sustainable outcomes not only based on the margin or finance-related scope but environmental and social perspectives too (Kannan & Tan,2005). The other concern is the outcome of the value chain activities of green perspectives. Porter (1985) initially explained the competitive advantages based on differentiation and cost leadership perspectives. However, the sustainability-related outcomes entirely aligned with those of some

environmental standards like ISO 14001 (Weber, 2008). Stakeholder satisfaction is another theoretical gap found compared to the generic value chain suggested by Porter (1985). Green value chain activities have to align with society and the national perspectives refereeing to the rules and policies of the country when expecting outcomes to the organization (Kannan & Tan, 2005). Thus, initiatives like Corporate Social Responsibility (CSR) activities are also essential to include in the environmental friend value chain orations. However, the initial model den does not explain those areas in detail within the generic value chain model demanded by today's organizations (Markley and Davis, 2007). Meantime, green value chain activities of a firm need environmental innovations to get suitable outcomes (Boons & Wagner, 2009).

Nevertheless, the initial value chain model does not focus on those areas in the firm infrastructure or Research and Development activities by seriously paying attention to those eco-innovations. Empirical arguments are fund claiming to investigate the mediating role of environmental innovations of firms towards suitable outcomes which are not entirely or enough discussed in the original value chain models (Boons & Wagner, 2009; Christmann, 2000; McWilliams & Siegel, 2000). Therefore, the theoretical gap is found compared to the practice patterns of the green value chain activities in the modern business era whilst manufacturing sector firms have to apply some country or industry-specific environmental methods. Such practices and the generic value chain activities proposed in the accepted model find deviations highlighting theatrical gaps and arguments. For instance, cement industry-related environmental practices are very curtailing as per the materials, methods, and environmental sensitivity it does have (LafargeHolcim, 2017). However, such practices are not associated with the initial value chain model that many organizations follow. Therefore, this study also addresses this particular theoretical gap and arguments claimed by previously held studies.

The cement cooperation recently acquired Holcim in Thailand and now operates under the corporate name Siam City Cement (Lanka) and the brand name INSEE Cement Lanka. Below is an indication of the manufacturing output, energy consumption and carbon dioxide emission from 2012 onwards (LafargeHolcim, 2017). As per the brief described above, this study addressees' empirical justification for claiming the cement industry is a critically important sector of the world economy, including Sri Lanka. Sustainable strategies and Adaptation to firms' business processes is a crucial concern in Sri Lankan industrial sector that demands strategic initiations and readiness on innovations, processes, quality and differentiation

(Munasinghe &Dissanayake, 2017; Rehan and Nehdi, 2005). Meanwhile, the role of firms in environmental innovation is highlighted as one of the mediating mechanisms to determine sustainable performance (Porter & Van der Linde, 1996; Rimmele *et al.,* 2008). The green value chain implementation has become challenging in meeting its expected results to gain sustainable performance for the organizations (Chien & Shih, 2007; Rimmele *et al.,* 2008). Alongside he said empirical gaps and performance issues, this study defines its research problem as a way of strategizing the green value chain effectively in order to gain sustainable performance where environmental innovation plays a mediating mechanism within" (Banbury, 1975; Betts & Tadisina, 2009; Chien & Shih, 2007; Rehan & Nehdi, 2005). Then the study focuses Sri Lankan cement industry as the research context addressing empirical, and performance gaps claimed (LafargeHolcim, 2017; Munasinghe & Dissanayake, 2017).

1.2.2 Empirical gap

From the perspective of the Empirical gap, as per the above discussed facts it can assess have started to consider green sustainability as a critical area of study and implementation in organizations that have an operation of practices which country due to pollution (Creswell, 2014; Dawes,2009; Knight & Jenkins, 2009; Revilla & Knoppen, 2015). However, there is considerable debate as to how organizations can conduct sustainable development in the creation and implementation of green value chain principles was maintaining a competitive advantage (Rao & Holt, 2005; Tan *et al.*, 2002; Tan & Zailani, 2009; Zhang *et al.,* 2015; Zhang *et al.*,2016). The intervention of innovation in the organization is another critical challenge in manufacturing sector organizations in adopting green supply chain functions and value-creating processes toward sustainable performances (LafargeHolcim, 2017; Zhang *et al.*, 2016). according to this study global cement industry has a strong influence due to the critical performance issues and challenges within the manufacturing scope which leads toward sustainable financial and market performances in terms of green value functions (LafargeHolcim, 2017; Munasinghe &d Dissanayake, 2017; Knight & Jenkins, 2009; Revilla &Knoppen, 2015). By continuously improving the material transformation process, a manufacturing system aims to constantly reduce costs and increase value-added to its products and services. Holcim Lanka started the co-processing in 2002. Rice husk and sawdust were the key alternative fuel used. There was a change in strategic direction to move from agricultural waste to industrial waste, especially hazardous waste, and a dedicated business unit was formed in 2004 to carry out co-processing. A detailed survey on waste generation was done, focusing

especially on hazardous waste during the same year. The first waste marketing plan was formulated to enter the hazardous waste market. In 2005, industrial waste co-processing started, and the first load of pharmaceutical waste was co-processed with the approval of the Provincial Environmental Authority (PEA) of the North Western Province (NWP) and the Central Environmental Authority (CEA). Geocycle also took steps to apply for a general permit to co-process waste by submitting a detailed project proposal to the PEA of NWP as a prescribed project. To win acceptance for co-processing among its focused stakeholders, Geocycle launched a long-term communications strategy, also in 2005. By 2006, the total industrial customer base consisted of 22. To gain a general permit for hazardous waste co-processing, Geocycle started the Environmental Impact Assessment (EIA) study while continuing to provide solutions for non-hazardous waste and obtaining permits for hazardous wastes on a case by case basis. Taking another development in its strategy, in 2007, Geocycle started supplying total solutions to Colombo Dockyard PLC, a large-scale industrial waste generator, building up a partner network to handle wastes not diverted to co-processing. Geocycle adopted the global identity the same year and started operations of its first pre-processing facility in Peliyagoda. In October 2008, cement kilns operated by Holcim Lanka demonstrated their ability to thermally destroy a hazardous waste to a Thermal Destruction Efficiency (TDE) exceeding 99.9999%, considered acceptable global standard. The kilns' TDE was assessed using wastes containing Polychloro Biphenyl (PCB), monitored by an independent group including Environmental Authorities of Sri Lanka. In 2008, Geocycle obtained the first Environmental Protection License (EPL) for hazardous waste co-processing in cement kilns to a list of wastes, enabling it to accept a large range of hazardous waste. It also expanded its operations to provide a solution to the waste of 84 companies in the Katunayake Export Processing Zone (KEPZ) and signed a contract with the BOI. Expanding its capacity, Geocycle constructed and opened for operations the first fully-fledged pre-processing plant to process hazardous waste in the KEPZ. By 2010 the total customer base consisted of 194, and Geocycle was able to co-process more than 40,000 MT of waste. Hence, an effective value chain (Chien & Shih, 2007). s will eventually lead to top-line improvement or profit generation (Liu *et al.*, 2016; Sampson & Spring, 2012). In addition to these traditional underpinning dimensions, the connotation of the value chain has evolved, further refined and extended to embed environmental aspects. The newly transformed concept emerges as green value chain (Chien & Shih, 2007; Liu *et al.*, 2016). In order to be successful with environmentally-friendly practices, environmental strategies must be integrated into all stages of the value chain (Chien

& Shih 2007; Rabello *et al.*, 2007). Rabelo *et al.* (2007) defined Green Value Chain as life cycle processes to support the physical, information, financial and knowledge aspects for moving products and services from suppliers to customers. Ketchen *et al.* (2008), on the other hand, defines Green Value Chain as a system of people, activities, information and resources involved in creating a product and then moving it to the customer. As the name implies, the primary focus is Green Value Chain (Chien & Shih, 2007). s is upstream-pivoted, mainly on integrating supplier and producer processes, reducing waste and costs, improving efficiencies of green value and the flow of materials from their various sources to their final destinations. Sustainability within the business context is simply explained as an interrelated matter between business goals and environmental conservation (Hawken *et al.,* 1999). It is said that environmentally friendly business models could create competitive advantages for a firm leading to better financial performance verifying how suitability is linked with the overall performance of a firm, including industrial sectors like cement (Engardio, 2007; Hart *et al.*, 2007). The business process and how it has been framed with the environmental connections can be noted in different industries and scenarios, including climate changes, recycling and energy conservations linking to performance subsequently.

The environmental impacts in the short term are even harder to calculate, though some, like the fall in greenhouse gas emissions and the improvements in air quality, are more instantaneously measurable. The impacts of less effective wildlife and environmental regulation and enforcement, and the delays too many current policy developments, will not be known for quite some time, and in some cases, not for several years. These range from poaching to the COP26 outcomes (Douglas, 2016).

It is too early to establish exactly where and by how much the emissions reductions have taken place. Nevertheless, there are early indications that nitrogen dioxide (NO2) emissions have fallen by almost half in a number of European cities (European Environment Agency 2020), overwhelmingly the result of the collapse of transport demand. Greenhouse gas emissions fell sharply in February in China, but with the beginning of a rebound from late March. The scale of the falls may have been around 20 %. (Utility Dive 2020).

The low or negative actual costs of debt reduce the incentive to save and increase the incentive to consume. Higher consumption causes higher emissions and more significant environmental damage. The relevant counterfactual is: what would have happened had accurate interest rates

followed the historical norm and approximated the longer-term growth rate (Del Brio *et al.*, 2017)? Suppose the real interest rate had been around 2% between 2000 and 2020. The level of debt and the levels of consumption and savings would have been different, and asset prices would have been significantly lower (Graham, 2018).

Suppose now that the monetary exceptionalism is continued, or even exacerbated, as a result of the pandemic. All of the above can be expected to be repeated. Asset prices will remain inflated, debt levels will increase, and consumption will dominate savings. (Helm 2020).

Lower interest rates and QE will both reduce the cost of capital for investments and reduce savings. The former will lower the cost of investing in renewables and nuclear electricity generation, most of which are capital-intensive (typically with zero marginal costs). This cost of capital effect will not, however, offset the fall in oil prices since it applies to all technologies and not just low-carbon ones. The outcome will probably depend on what governments do, whether the lower cost of government borrowing is translated by governments into renewables and nuclear investments, and whether the lower price of oil is offset. In other words, what matters is whether environmental policies are designed to benefit from the monetary conditions central banks create and by carbon taxes.

All significant economies responded to the 2007/08 crisis with fiscal stimuli. Debt levels as a ratio to GDP subsequently rose in China, the US and EU member states. With the exception of Greece and, to a lesser extent, Italy and Spain, none led to a reluctance to lend to governments, and eventually, all EU member states saw interest rates fall back to their deficient historical levels, supported by QE from the European Central Bank, which vowed to "do whatever it takes" to reduce interest rate spreads (Graham, 2018).

Subsequently, the EU countries have tried to limit and, in the case of Germany, eliminate the deficits that arose. But as the world economic outlook darkened in the second half of 2019, many countries abandoned attempts to reduce their deficits. The political cover for more significant fiscal expansion was typically cited as an investment (though not in the US, where the mechanism was tax cuts). It was argued that investment, backed by borrowing, did not worsen the underlying fiscal position. In other words, a policy U-turn was widely deployed, and now it was argued in the EU and the UK that the aim of balancing the overall budget had been economically inefficient, and greater attention should have been paid to the balance sheet,

with investment, asset creation and liabilities fully taken into account. (The US had never seriously attempted to bring its budget back into balance.) IEA (International Energy Agency , 2010).

In response to the coronavirus, fiscal stimuli have already been significantly increased in most EU countries, including even Germany, and measures have been taken in the US and China too. The EU has proposed a €500 billion package (around $545 billion), while the US Federal Reserve has announced a $2.3 trillion package. Some of this spending would have happened anyway, as the automatic stabilizers kick in to pay for higher unemployment costs and lower tax revenues. These measures are about increasing aggregate demand and have an underlying Keynesian rationale. (Graham, 2018).

From the environmental perspective, the questions are about the impacts of the spending on GDP, the split in the impacts between consumption and investment, how the investment component is spent, and in particular, the willingness of governments to engage with climate change and other natural capital enhancement projects. It is not the fiscal stimulus that matters for the environment (although it does affect consumption, as discussed above), but rather its composition and how this reflects on the balance sheet (International Energy Agency , 2012).

Fiscal stimuli will increase the demand for energy, transport and agricultural products. They will also increase the timber and the derived demand for rainforest products. The demand for products like beef (from the Amazon), hardwood (from all rainforests), hydroelectricity (dams on all the major rivers) and palm oil (from Malaysia and Indonesia) will rise as a result. In other words, the demand for primary natural resources goes up, and the level, especially the composition, of GDP in the years following the coronavirus will depend on the extent and nature of the fiscal stimuli. IEA (International Energy Agency, 2010).

Mindful of the composition effect of monetary and fiscal stimuli discussed above, some have argued that the apparent policy to pursue is a public infrastructure investment strategy in a classic demand and supply shock. A vital part of this should be a new climate change package—a green deal. Some have even referred to this as a new green "Marshall Plan" (European Commission 2019, 2020a, b). IEA (International Energy Agency, 2010).

There are two parts to these proposals: claims about the superior economic returns to such investments, considered broadly to include environmental resilience and distributional impacts, compared with alternative investments; and proposals for funding and financing this expenditure. It is sometimes argued that renewable energy investments, for example, are already cost-competitive with fossil fuel alternatives or will be shortly. If it is true, then this investment will happen anyway, and there is no need for additional subsidies; hence there is no need for a green deal. Few advocates of green deals are willing to accept this conclusion. Alternatively, the justification for a green deal rests in principle on the difference between the higher costs of green investments and the implied carbon price that would have achieved the climate change objectives, notably net zero IEA (International Energy Agency) statistics (2010). The apparent economic policy to close this gap would be to impose the carbon price, domestically and at the border, and then the macroeconomic green deal would again be unnecessary. What is missing is an argument for using government subsidies instead of correcting market prices for pollution costs. (International Monetary Fund 2020).

If the renewables were not on a path to very quick cost-competitiveness in 2019, the sharp falls in oil, gas and coal prices referred to above have changed the arithmetic further. Worse, from the renewables and nuclear perspectives, the costs of fossil fuels, from extraction and refining to transportation, are likely to fall as a result of the price falls as they cascade through the supply chain, through to steel, labor and other suppliers: costs and prices tend to be correlated. Renewable generation lobbyists are keen to point to the falling costs of renewables but less willing to carry the assumption over to fossil fuels, where technological progress in the last decade has been extraordinarily fast. Renewable lobbyists also avoid comparing apples with apples, neglecting the system costs of intermittency and decentralized and disaggregated generation (Helm 2017b, chapter 7).

The second part of the argument relates to the relative economic returns between different types of investment, assuming that an investment stimulus is a correct response to macroeconomic shocks. The assumed priority for green investments is far from obvious. For example, the returns to road building can be high, as well as to house buildings and airports, even if a carbon price is factored in (Highways England 2019; Highways England 2015). Even with a high carbon tax, the costs of fossil fuel-powered cars may be lower than electric ones. The pandemic

has revealed the returns to health expenditure as much higher than previously anticipated. (International Monetary Fund 2020).

In addition to health, the one aspect of the infrastructure whose economics has been markedly improved by the pandemic is communications and, in particular, fiber optics. The switch to video and other virtual communications and work practice during the lockdowns highlights the system benefits of total fibre and points towards an emerging Universal Service Obligation (USO), notably in the UK and the rural US. (Helm 2017b, chapter 7).

As long as the government's total investment budget is limited, choices and trade-offs will be made. The green deal investments might not turn out to be the highest priority. However, it is essential to have fibre to facilitate the decarbonized electricity and transport systems in the intermittency and the minor disaggregated nature of decentralized renewables generation (Helm 2017a, chapters 10 and 11).

Much of this pollution has been associated with producing goods for consumption by other countries, notably by the US and the EU, comprising a significant share of world GDP. The Chinese growth model has been much debated, but at its early core has been the export of carbon and energy-intensive goods (Pan *et al.,* 2009). The corollary of this has been the relative decline of home production in the US and especially in the EU of steel, fertilizers, petrochemicals, aluminum and even cement (the big five traded carbon-intensive goods), partly supplanted by the Chinese exports. In other words, much of this pollution in China has benefited US and EU consumers. Utilizing territorial carbon production measures for the climate change targets has disguised this causal relationship and painted an unduly rosy picture of EU efforts to reduce emissions while at the same time increasing global warming by increasing the carbon emissions in China. Hence the relentless growth in the concentration of carbon in the atmosphere (Kalhara, 2018).

Some commentators argue that the coronavirus will encourage a retreat to a greater emphasis on national production and domestic security of supply, which will, in turn, reduce the pollution from shipping and aviation and reduce global pollution since environmental standards are higher in the US and Europe generally. Coal is a much smaller proportion of energy inputs to this production. It assumes that globalization harms the environment, improving the adverse outcomes of delocalization compared with what they would have been. And that the pandemic

has caused this delocalization. Again, the counterfactual matters in working out what the contribution of the virus will be: the growth of world trade was already slowing in 2019, and the coming of digital technologies would probably have slowed it even further. Robots replace cheap labor, do not sleep or require welfare payments, and do not catch the coronavirus. Economic growth may decouple from the model, which relies on locating production close to cheap input costs as opposed to customers, with robots and 3D printing playing enabling roles. (Helm 2017).

The virus has, as noted, reinforced the perceived importance and power of nation states over global institutions. The World Trade Organization appeals body is already not functioning because the US has not nominated a new member to make it quorate. The widespread Adaptation of state aids has exacerbated protectionist moves already in place. These impacts should be sufficient to limit the bounce-back of trade and, therefore, the associated shipping and aviation demand post-lockdowns. The net environmental impact will also have to consider the other environmental effects of production in different locations. (Helm 2017). The coronavirus almost certainly makes intergenerational imbalances worse. In the short term, the young are likely disproportionately disadvantaged by the coronavirus lockdown since they are more represented in the leisure, entertainment, restaurant and travel industries (Joyce and Xu, 2020). The mainly young escape severe health impacts from the virus, whereas the old (especially the over-65s) comprise most deaths. There will be longer-term consequences: the young will inherit the debts, and the more expansive monetary policy responses may further inflate the prices of critical assets such as housing. (Helm 2017).

These general impacts of pollution, debt, the additional debt and asset inflation impacts on the next generation arising from the response to the virus itself, and any slackening in political willingness to address the damage to the climate and biodiversity, will together probably cancel out the gains that would be made by applying a lower discount rate to investments which the monetary stimuli will cause (Kabir *et al.,* 2010). A lower discount rate makes the future more essential and tilts investments towards the longer term. However, in practice, there will be a budget constraint rationing public expenditure, exhausted by health and social care spending and the other consumption-supporting measures to address the immediate crisis. The beneficiaries of higher current expenditures and the health investments are probably going to

be more heavily among the current generation—for pensions and end-of-life health costs, for example. (Helm 2017).

Empirical justifications are funds claiming to investigate environmental sustainability in terms of less use of resources, waste management, and fewer pollutions as value addition options within business operations (Schmidheiny, 1992; Lovins *et al.*, 1999). The connection between sustainable practices for business performances explained via profits and competition is empirically explained to investigate in different business fields, whereas Sri Lankan cement manufacturing giants highlighted the same (LafargeHolcim 2017; Sinding, 2001). Economic impact and the competitive advantages of sustainable business strategies have been mentioned and claimed to be investigated further in different contexts (Lash & Wellington, 2007; Sharma *et al.,* 2010). Manufacturers must adapt to reasonable practices and revitalize the value chain (Chien & Shih, 2007). It should be a green process due to resource limitations, rules, government pressures, and social pressures coming from stakeholders (Sharma & Ruud, 2003). Sri Lankan manufacturing firms are adopting green-friendly business models due to pressures and resource shortages, including their company philanthropies. Whereas the manufacturing and construction sector of Sri Lanka play a critical role in the economy (Central Bank of Sri Lanka, 2018; Central Environment Authority of Sri Lanka –CEASL, 2017). Two companies mainly dominate the cement manufacturing sector of Sri Lanka. In contrast, Holicm leads the process and has taken substantial measures within its value chain that contains green activities and a lot of community services. CSR activities are conducted globally (LafargeHolcim, 2017).

Overall, it is said that green-friendly products have increasing demand, and consumers tend to respond positively to those (Koler, 2003). Cement manufacturing companies in Sri Lanka also apply the same procedures to provide a green-friendly product, but the challenge is to determine how the overall performance rewards the system. Conclusively, sustainability and the measurements of its outcome for the firm had been discussed about supply chain activities, green production outcomes, the effectiveness of the business strategy, the green behavioral response of the customers, waste management, competitive advantages and the firm profitability or financial gains (Berman *et al.,* 2002; Holweg & Pil, 2001; Salvador *et al.,* 2002; Sharma & LaPlaca, 2005; Esty and Winston 2006; Hawken *et al.,* 1999; Lindsay *et al.,* 2006). Accordingly, this study examines the research problem above, focusing on the empirical gap.

1.2.3 Industry selection and Practice gap

Despite its popularity and profitability, the cement industry faces many challenges due to environmental and sustainability issues. It is fundamentally an energy-intensive operation and not at all environmentally friendly by nature. Furthermore, it consumes large amounts of non-renewable raw materials and generates substantial amounts of carbon dioxide and environmental particulate matter. In general, near 5-6% of all carbon dioxide greenhouse gases generated by human activities originate from cement production, which can have the propensity to increase up to 18% at its current growth rate by 2030. According to WWF, the industry - now responsible for some 6 per cent of human-caused greenhouse gas emissions - is likely to become a more significant contributor to climate change than the European Union by 2030 unless cement plants become efficient or transition to renewable energy sources (Schneider, 2015). As this thesis focuses on cement manufacturing, the primary consideration will be the local Sri Lankan cement manufacturers that directly contribute to carbon dioxide emissions. Holcim cement is the only local manufacturer that currently does mass production of cement in Sri Lanka (LafargeHolcim, 2017). Despite incorporating a myriad of benefits outlined briefly in the previous parts of this study, real-life practices of the green value chain can create certain obstacles for businesses. The range and scope of these obstacles can vary depending on the scale of the business, from minor to medium enterprises to multinational companies, yet most of them bear standardized characteristics. Five main areas measure obstacles faced during the green value chain implementation, such as outsourcing, technology, knowledge, financial, participation and support (Govindan *et al.,* 2014). A non-negligible portion of obstacles originates from the internal dynamics of the business, which can arise from customers, vendors and governments. Non-availability of bank loans to finance green products: Companies make an effort to get bank loans for environmental initiatives (Govindan *et al.,* 2014). Financial institutions may not be as sensitive even if companies have environmental awareness. Financial institutions that expect high profits in the short term may raise difficulties for companies in providing loans. The costliness of disposal of risky materials: Eliminating dangerous substances in environmentally friendly ways is an extra cost for companies. Therefore, some companies may avoid this cost and prefer to release dangerous substances into the environment. This obstacle is determined as the most dominant low-level obstacle. (Jayant & Azhar, 2014) The costliness of transition to green systems: Transitioning the company to a system compatible with the environment may require a high initial cost (Mudgal *et al.,* 2010).

Although, in the long-term, companies will benefit from this transition, minimal and medium-sized companies avoid high initial costs. The costliness of green/environmentally-friendly packaging: Damage to the environment can be minimized by reducing shipping and packaging costs. (Walker *et al.,* 2008). Transitioning to environmentally friendly packaging is one of the company's most important indicators of environmental sensitivities. The costliness of collecting used products: Collecting used products is costly for companies (Govindan *et al.,* 2014). Collection and recycling of these products from end users and vendors is a complex problem. Lack of training activities for green product applications: Education and innovation can ensure that the obstacles are overtaken and succeed in projects (Carter & Dresner, 2001). However, the lack of experts in green procurement is the biggest problem faced by companies. Lack of awareness in adopting reverse logistics: Although reverse logistics applications provide direct benefits to the environment, the fact that companies are not aware of these benefits is a major.

An obstacle to reverse logistics is that the awareness of companies about reverse logistics practices will directly contribute to the understanding of green procurement (Ravi & Shankar, 2005). Lack of convincing parties on the environmental benefits: If governments act as a persuasive party in ecological structuring, this will cause tiny firms to provide more contribution to the process. (Revell & Rutherfoord, 2003). The fact that governments are not trying to raise awareness about green procurement is one of the difficulties. Lack of knowledge on environmental issues: Lack of trained staff and experts is considered a critical obstacle in organizations (Shen and Tam, 2002). The companies should resolve the conflicts on knowledge through internal or external training. Lack of awareness of environmental impacts on business: Being aware of the positive effects of environmental practices on companies in the long term is a factor that will directly encourage companies. Therefore, if businesses are unaware of the effects of environmental practices, this will pose a severe obstacle to green value chain practices. Insufficient information technology applications: Knowledge quality significantly positively affects environmental management performance (Wu & Pagell, 2011). Among producers, inadequacy in applying information technologies based on environmentally friendly requirements is a critical obstacle for the green value chain. Resistance against adopting advanced technologies: Successful Adaptation and implementation of advanced technologies are essential factors in improving environmental management performance (Hosseini & Ivanov, 2020). Unsurprisingly, businesses resistant to adopting and implementing advanced

technologies experience difficulties in green value chain implementations. The difficulty of designing processes that recycle used products: Recycling has a crucial role in environmental practices. However, the design of recycling operations is a complex and challenging process (Barros *et al.*, 1999). Insufficient technical expertise is a critical obstacle to strategic planning, especially considering human resources and time constraints in small and medium-sized enterprises (Chen, 2009). Companies may have access to knowledge and professional expertise with the help of various programs. Insufficient flexibility in transitioning to new systems: Switching to a new and environmentally conscious system may not always be easy. Sometimes this process may cause technical, financial and managerial problems. Market competition and uncertainty: Environmental uncertainty and market competition directly impact the intention to adopt green innovations (Lin & Ho, 2008). The external environment in which a company operates also affects the intention of the company to adopt innovations. Insufficient government support: Government regulations can encourage and discourage enterprises from adopting innovations (Scupola, 2003). Inadequate government support is a factor that discourages enterprises in the green value chain implementations. Lack of top management commitment: Top management commitment is empowering, changing, formulating policies, and progressing and monitoring strategies to ensure that primary production and business strategies are positioned (Digalwar & Metri, 2004). It is difficult for green value chain applications to succeed without top management's support and effort. Insufficient customer awareness: The quality of the product returned at the end of its economic life and uniformity of this quality are essential factors to affect green logistics. (Ravi & Shankar, 2005). Thus, customers must be aware of product recycling at a certain level. Fear of failure: Green value chain requires high initial investment and may lead to some difficulties at first, then brings success in the long term. Therefore, the fear of failure that may arise in enterprises and employees is a severe obstacle to the transition to the system. Restrictive company policies: Policies and targets, defined and developed continuously at each organization level for pollution prevention and waste minimization, are the primary requirements of environmental consciousness (Beamon, 1999). Therefore, restrictive company policies are barriers to the process (Amit & Pratik, 2012).

1.2.4. Problem Statement

As per the empirical gaps mentioned in this study and the practice related issues highlighted, the Researcher has organized the main research issue supported by theoretical association as

described above. The main research problem of the study is ***"What factors affect the effective adaptation of Green Value Chain Strategy in Industry Sustainability of the Cement Manufacturing Sector of Sri Lanka".*** Accordingly, a research study was framed based on the main research problem statement and the research questions.

1.3 Research Questions

As per the research problem, this study has defined the research questions addressing the direct and indirect relationships of the variables that are cleared with empirical and performance gaps. Alongside, four research questions have been recognized as undermentioned.

- What is the impact of Green Value Chain Adaptation's on sustainable performance within the cement manufacturing industry of Sri Lanka?
- What is the impact of Green Value Chain Adaptation on Environmental innovations in the cement manufacturing industry of Sri Lanka?
- What is the impact of Environmental innovation on sustainable performance within the cement manufacturing industry of Sri Lanka?
- Does Environmental innovation mediate the impact of Green Value Chain Adaptation on sustainable performance within the cement manufacturing industry of Sri Lanka?

1.4 Objectives of the study

Researchers intended to address the research objectives according to the research questions and contribute to managerial implications. Alongside, the research objectives have been identified as follows.

- To examine the impact of Green Value Chain Adaptation toward sustainable performance within the cement manufacturing industry of Sri Lanka.
- To evaluate how Green Value Chain Adaptation impacts Environmental innovations within the cement manufacturing industry of Sri Lanka.
- To investigate the impact of environmental innovation on sustainable performance within the cement manufacturing industry of Sri Lanka.

- To determine whether environmental innovation mediates the impact of Green Value Chain Adaptation on sustainable performance within the cement manufacturing industry of Sri Lanka.

1.5 Significance of the Study

The significance of the research will have a direct bearing on the Sri Lankan cement industry is illustrated in two segments managerial impact and knowledge and impact. Accordingly, based on the managerial impact, it will identify critical concerns of existing stakeholders that the organizations need to address to be sustainable in the future. The research will address serious areas such as emission management, raw material management and process management, which will benefit cement manufacturers worldwide, focusing on adapting sustainable manufacturing through green values and principles. The academic significance of the research will contest the drawbacks of the classic value chain. The value chain theory can address the new dynamics of stakeholder expectation in today's business context, which requires organizations to be more responsible in the manufacturing processes beyond merely generating profit margins. The research identified that Green Value Chain represents stakeholder expectations more accurately. Concepts will indicate the need for modifying the classic value chain.

In terms of the knowledge impact, modifying classical values chain principles will have a broad implication for similar industries globally that contribute to high carbon dioxide emission rates. These industries currently practice the classic value chain theory that will need to re-evaluate their business philosophies to adopt the proposed modifications to achieve sustainability. This study's findings significantly contribute to cement manufacturers in Sri Lanka, to revisit their business model in terms of ensuring how their value creation process is well integrated with the supply chain process to result in sustainable business performances whilst innovative environment practices are connected to the existing value chain. The managers and supervisors who work in leading cement manufacturing companies have been considered this study's respondents. Thus findings of the study could be used to analyze the responsiveness of managers and supervisors towards the value creation models of the cement manufacturing and selling companies in Sri Lanka. Accordingly, industry practitioners could make suitable measures to incorporate human resources and innovative value creation strategies to meet suitable business performances.

1.6 Limitations of the Study

Several minor and significant limitations associated with this research project are outlined below. In the first instance, a substantial lack of existing literature on the subject is a significant handicap. Secondly, the limited sample population for both the questionnaire and the survey is unlikely to permit the researcher to draw broader conclusions on the implications of the research program. While obstacles particularly relate to national and international regulatory frameworks, opportunities have a qualitative impact on a sustainability management program. While the qualitative shift in favor of better maritime training is attributable to such variables as infrastructure and regulations, the need for creating better awareness among potential trainees in the cement manufacturing industry of Sri Lanka is quite understandable.

Response-related errors could sometimes be relatively high though the researcher would exercise enough care to prevent them. Some respondents may make wrong interferences and give wrong answers. Making Intentional Mistakes: Respondents may intentionally make mistakes or interpret facts. The respondents submit information without understanding the problems the researcher can face.

1.7 Chapter organization

Chapter – 1-discusses about the main research problem, background, research objectives and the significance

Chapter – 2-a critical literature analysis based on the existing conceptual and empirical evidence to base the study on significant research backed up by academic evidence

Chapter – 3-disuses the primary methodology used by the study to ensure that the intended objectives have been achieved through the use of quantitative and qualitative techniques. It also includes the method of analysis, model specification, hypothesis development and limitation of the study.

Chapter – 4 - presents the findings of the results, discussion and analysis of the findings. Conclusion and recommendations drawn upon the research study have been presented in chapter five.

Chapter – 5- this chapter relates to the critical model developed as a solution to the execution of sustainability practices by cement industry firms targeting the green policy standards on a corporate level.

CHAPTER II LITERATURE REVIEW

2.1 Introduction

This literature review is to investigate the evolving relationship between Green Value Chain. Adaptation son sustainability strategies are about the cement industry. With the rising industry in construction, there is an exceeding demand for cement manufacturing. In such a background, it is essential to vest sustainability and resource conservation concerns to minimize carbon emissions to the atmosphere in cement manufacturing plants. The researcher has discussed the theoretical and empirical background in the following literature review.

2.2 Theoretical Overview on Value Chain Strategy

2.2.1 Global impact of the Cement Industry

It is inconceivable to consider a world without cement, especially with the growth of the population moving toward 8 billion people, it is reasonable to understand that there will be more construction requirements for infrastructure, housing and business development that will all revolve around the consumption of cement (Ighalo & Adeniyi, 2020).

The cement and the concrete industry have grown to become one of the largest contributors to the world economy in every single country across the globe providing vital jobs, governmental revenue and economic growth options both directly in its role as a manufacturing plant and indirectly through secondary associated industries which has realized that modern day life would not have been possible without the use of cement and concrete. According to Hansen and Park (1995), concrete in terms of its production is 2nd only to water in its consumption by people. It exceeds its rival steel by 30 times of volume and 10 times of mass (Hansen & Park,1995).

According to U.S Geological Survey 2011, the cement industry produces 4.3 billion tons of cement for which 4.1 billion tons of clinker each year. The projected annual growth of the cement industry at 7% to 8% each year to cater to the increasing demand for this product. The primary process in cement manufacturing comprises quarrying, crushing, clinker manufacturing and cement milling.

Preheating the Kiln feed involves high levels of energy consumption, where electricity used in non-renewable energy. The overall cement industry contributes to approximately 5% of global energy consumption and nearly 7% of the total CO2 emissions as per the world energy council in 2014 (Yusuf *et al.*, 2014).

The greenhouse gas effects cause an increased temperature by reducing the thickness of the ozone layer because of carbon dioxide proliferating into the atmosphere use of primary concern to many stakeholders that are closely associated with businesses that have high levels of carbon dioxide emissions. Industries targeted heavy legislation over the past few years by identifying this industry as one of the largest contributing to carbon dioxide through sources such as vehicle manufacturing, drilling for crude oil, steamship lines, the airline industry and even cement manufacturing (Rimmele *et al.*, 2008).

2.2.2 Overview of the Local Industry

Cement is a binding substance that is mixed from a powder into a semi-liquid form which hardens once exposed to room temperature. Cement essentially functions as a glue that can bind various substances to create a structure. The origin of the word cement is traceable from the Roman Empire, through which the original Latin translation “opus cementum” was used to describe masonry work (Fernando, 2011).

Ordinary Portland cement was discovered by Joseph Aspadine in 1823, the city of Portland England. His formula was a composition of heating limestone mixed with other materials such as clay in a Kiln resulted in a substance called 'clinker’, which was grounded to a powdered form by adding small amounts of gypsum which are ground together to plan the product known as cement (Fernando, 2011).

The composition of OPC is 95% link and 5% gypsum, which is the oldest recipe originating from 1824 onwards. With the use of modern technology and the emergence of different other materials combined to make cement in today's industry, there are over 27 different types that are currently used in all forms of construction and concrete (Fernando, 2011).

Sri Lankan Cement Corporation was the government-owned entity manufacturing cement plant in Sri Lanka. They established the plant in the northern province of Sri Lanka in the town of

Kankesanthurai under the name of “Kankesan Cement”. They established two other cement manufacturing plants in Sri Lanka in Puttalam and Galle, which operated under the brand name of “Sanstha” under the sole ownership of the Sri Lanka cement corporation within 10 years (Fernando, 2011).

TOKYO super cement Lanka Limited which is Japanese-based manufacturer was the first private company started in Sri Lanka in 1982. This was a semi-integrated cement manufacturing plant established in the town of Trincomalee. Meanwhile, the private sector started the cement manufacturing in the country. In 1983, the government privatized the cement operating point in the city of Galle under the company name Yashoda Enterprises Pvt. Ltd that manufactured products under the brand name of Ruhunu Cement (Rajakaruna, 2011).

Civil unrest in the Northern part of the country shocked the nation for nearly 30 years and security concerns that become impossible for the local government to operate the cement plants in Kankasanthure and Puttalam. The companies ended their cement plants in 1996 because of civil unrest (Perera *et al.,* 2020).

Holcim became the second manufacturer to enter the market in 1996 by acquiring the Puttalam cement plant from the government. Holcim was an international brand where that had no issues operating in areas that were consistent with civil unrest, as the private organization had any political or ethnic lenience. Holcim gained the manufacturing plant in Galle and continued to corporate on the same brand name “Sanstha” (Lafargeholcim, 2013, 2015).

Tokyo Cement Lanka Limited and Holcim cement are the only two local manufacturers that currently mass produce cement in Sri Lanka. Research conducted by the JKSB showed that Sri Lanka's cement consumption was approximately 4.2 million tons per year in 2010, of which Holcim and Tokyo cement manufactured 1.4 million tons of cement manufactured 2.4 million tons (Tokyo Cement, 2021).

Tokyo cement is the market leader holding on to nearly 30% of the market share. As of 2014, it currently sells its products under the brand name Tokyo super. Holcim Controls about 20% of the market share with another three retailers, attributing to the balance 38% share with an overall 12% attributed to direct imports (Tokyo Cement, 2021).

While Holcim and Tokyo are the only two full-service manufacturers who conduct operations from the mining of limestone up to the packaging of cement in bags for distribution, Ultra-Tech, Lafarge and Singha bulk import cement and clinker that are processed and re-packed for distribution along the country (Perera *et al.*, 2020).

Several brands have made the balance of 10% of imports cement to Sri Lanka under specific trade agreements such as the Indo-Sri Lanka Free Trade Agreement (ISFTA) and Pakistan- Sri Lanka Free Trade Agreement (PSFTA) which allowed for the importation of cement on the duty-free basis. Sri Lankan Cement companies must sell their products according to the safety standards by conforming to the specification of the Sri Lankan Standards Institution (SLSI). Based on the regulations established in terms of safety and performance, all cement retail in Sri Lanka needs to fit into one of the following categories (Tokyo Cement, 2021):

- Ordinary Portland Cement (OPC) – SLS 107
- Portland Limestone Cement (PLC) – SLS 1253
- Blended Hydraulic Cement (BHC) – SLS 1247
- Masonry Cement (MC) – SLS 515

According to Tokyo Cement (2021), each type of cement mainly differs from the amount of clinker used during the manufacturing. The varying compositions of clinker on the above four types of cement are:

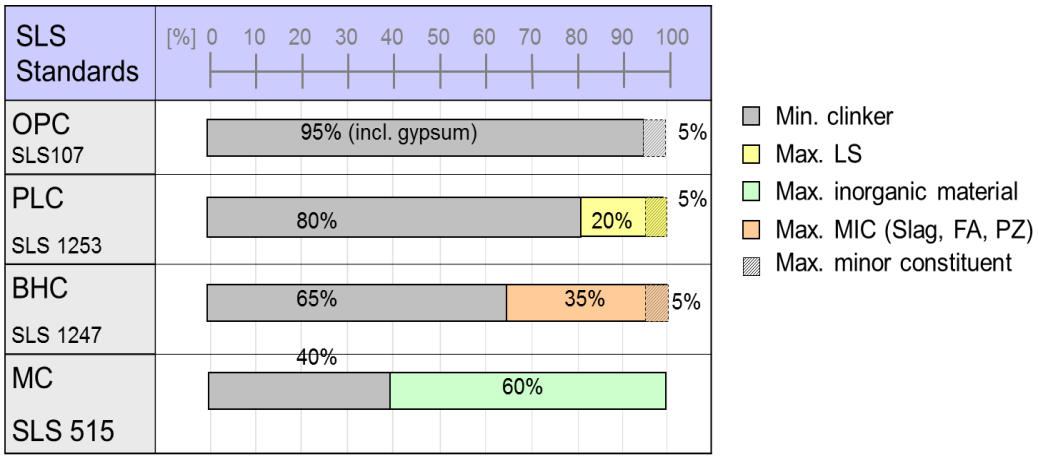

Figure 2.1 SLS Standards on Clinker Composition of Cements (Source: Sri Lanka Standards Institution)

Besides the above classification, which primarily deals with the chemical composite of the product, which has a direct correlation to the quality, standard cement, is also classified based on strength classification (Perera *et al.*, 2020).

The local cement industry is profitable, which contributes to the local economy as it not only contributes to the infrastructure development. Also, the industry impacts much-needed employment opportunities in the country (Perera *et al.*, 2020).

2.2.2 Impact to the Local Environment

Throughout the cycle of its value chain the cement industry has a large impact to the environment. Changes to the landscape which include deforestation and loose soil that can lead to landslides happen due to quarrying for limestone. The operations process of the value chain which deals specifically activities conducted in the cement mill result in high levels of CO2 emissions. The transportation of raw materials across the nation result in high levels of CO2 emissions (Bogahawatta & Herath, 2008).

2.2.2.1 Energy Consumption

Cement production causes higher energy usage and environmental impurity. It displays a comparison between the cement and clinker manufacture volumes with a similar capacity plan below to get a clearer idea of the energy usage levels (Bogahawatta & Herath, 2008).

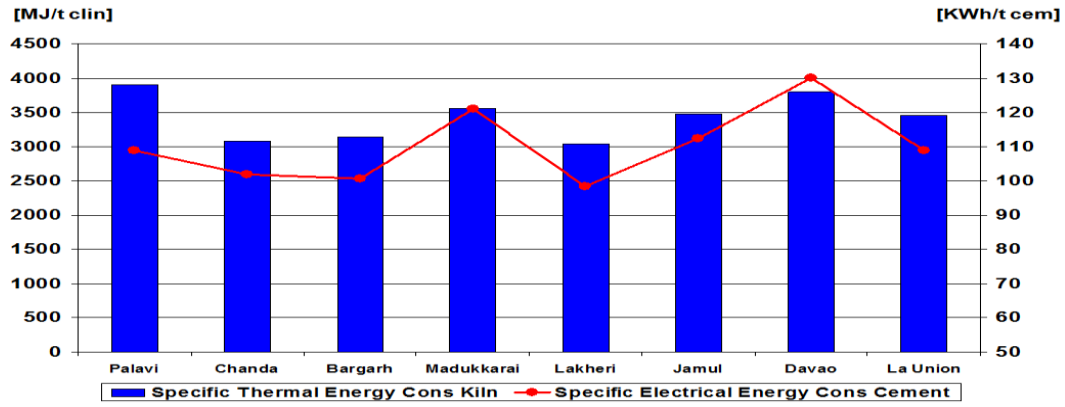

Figure 2.2: Thermal energy and electrical energy consumption comparison (Source : LafargeHolcim,2015)

The numerals established in the above figure speak for the thermal and the electrical energy along with an unambiguous correlation to the manufacture volume quantity of cement and clicker. Palavi cement has consumed the highest rate in manufacturing clinker of 3800MJ/ton, which has an output of 500,000 tons of clinker, which shows that an individual plant spends over 1,900 million MJ of current per year to produce clinker. The positive outcomes can originate in the atmosphere at any level of the Ordinary Portland cement production method. Airborne contamination in the systems of gases, dust, and the release of CO2 materials from the required natural resources in the manufacturing process. (Lafargeholcim, 2015).

2.2.2.2 Carbon emissions

The researcher calculated the CO2 emissions based on the amount of carbon emission per ton of cement. The following chart shows the carbon dioxide emission from 2013 to 2015. (Lafargeholcim, 2013, 2015).

Table 2.1: Carbon Emissions

2013	2014	2015
578 KGS per ton of Specific Net Cement	602 KGS per ton of Specific Net Cement	548 KGS per ton of Specific Net Cement

(Source- Authors Work based on Lafargeholcim report 2013, 2015)

Based on the projected environmental impact regulations, the figure average of 560 Kg specific of cement needs to be reduced at least by 40% over the next five years for the industry, which significantly contributes to the reduction of CO2 emissions.

2.2.2.3 Managing Stakeholder Expectations

Managing stakeholders' expectations has always been a critical aspect of any business. In growing years, this has become more challenging for organizations, as stakeholder expectations have diversified to consider an industry's impact on the environment. As the primary product base has always been the use of Ordinary Portland Cement, the overall industry has evaluated several options that can marginalize and improve the detrimental effect on the environment through the manufacturing process (The European Cement Association, 2015).

The cement industry influences the creation of environmental impurities because of the usage of natural resources and obscene CO2 gas. The cement industry subsidizes labour manufactured (7%), and the unintended source originated from the mark of natural resources gathering to transfer the ultimate result (4%). The antiquated production method used various raw materials (The European Cement Association, 2015).

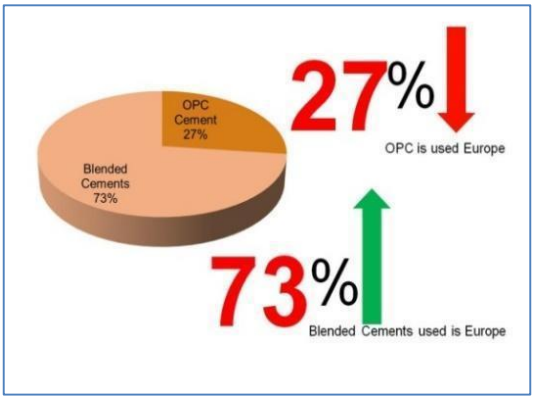

Figure 2.3: Usage of Cement in Europe – 2015 **(**Source: The European Cement Association - CEMBUREAU 2015)

To manufacture OPC comprise limestone, clay, gypsum and a few obsessive products that are fused to produce clinker. Clinker is a synthetic product produced by melting a proportionate blend of elements at a higher temperature of 1,450 °C (2,640 °F) placed in a rotary kiln. The crushing station creates the powered form of clinker, which is the base raw material for OPC. Meanwhile, fly ash, slag waste, silica fume, and iron ore are used in the blended cement which is used to create attributed cement for various operations (The European Cement Association, 2015).

"Cement 2050 Low Carbon Economy" was a report that was issued by CEMBUREAU (The European Cement Association) in 2014, which suggested that the major resource is limestone which is used to create clinker to provide industry CO2 diffusions up to 60% that result in transferring limestone to lime directly. The cement manufacturers can reduce limestone percentages in the manufacturing process by using materials that comprise calcium such as impurities and by-products. OPC contains clinker up to 95%, whereas the other balance is gypsum (5%). According to the European Cement Association (2015), the typical clinker-to-cement ratio is 73.7% in the EU27. The mixing of resources such as fly ash, slag, or silica

fumes decreases the clinker-to-cement ratio by 70%, which has an outcome of saving 4% of CO2 universally. Currently in the Europe and the Middle east, 73% of the cement uses in all heavy types of construction, even blending of concrete (The European Cement Association, 2015).

2.2.3 The Value Chain

When developing a strategy and achieving a competitive advantage, it is significant to note that a firm is not simply a 'black box' into which raw materials go where products emerge. Instead, a firm undertakes a series of steps which add value to the finished goods and turn them into the final product. These are the steps of a typical value chain in a company. Michael Porter (1985) defined a generic value chain featuring a series of activities that most firms undertook to add value to their final products or services. Porter (1985) claimed that the ultimate reason firms did these activities was to add value to the customer, which is greater than the cost of the activities to the firm. These activities allow a firm to sell the finished goods for more than the costs of production, which results in a profit margin for the firm and value creation for its shareholders.

Porter's generic model of the value chain features five primary activities and four support activities. The primary activities are those that directly affect the raw materials, work in progress, and finished goods (Porter, 1985). They are.

- Inbound Logistics: This refers to receiving and storing raw materials and other inputs and supplying them to the operations as required.
- Operations: This is the processor process by which they converted the inputs to finished goods.
- Outbound Logistics. This refers to the collection of finished goods from the operations and their storage and distribution to distributors, retailers, or customers.
- Marketing and Sales: This aspect involves identifying customer needs and marketing products that fill these needs.
- Service: This represents support for a product or service supplied by the company.

The four secondary activities of the value chain are:

- The organizational structure and control systems of the company, including its organizational culture.
- Human resource management. This includes all activities related to employees, such as recruiting, training and rewarding.
- Research and development of new technologies to add more value.
- The procurement of raw materials and equipment.

The firm's success in these activities will influence the value it can provide to the customer relative to the cost of the firm's inputs, labor, capital and other costs. The value added is effectively equivalent to the margin that the firm can charge, however, the firm can choose to vary its margin to make its product attractive to more or fewer customers. Indeed, perhaps the foundation of all competitive advantage is in a company's ability to configure its value chain to provide lower costs, greater differentiation, or specialist focus. A firm can get a cost advantage by reducing the cost of all its value-adding activities, can get greater differentiation by ensuring its activities add more value than competitors' and achieve specialist focus by configuring its activities to add more value to a specific market niche (Porter, 1985).

2.2.3.1 Cost Advantage and the Value Chain

A firm has two options when considering its value chain to build a cost advantage. Initially, it can attempt to reduce the cost of specific activities in a value chain and reconfigure the entire chain to eliminate non-value-adding activities. When trying to reduce the cost of certain activities, Porter argued that there are ten specific cost drivers:

- Create massive economies of scale
- Increase the rate of organizational learning
- Improve capacity utilization
- Create stronger linkages between activities
- Develop synergies between business units
- Look to increase vertical integration
- Improve the timing of market entry
- Alter the firm's strategy regarding cost or differentiation leadership
- Change the geographic location of the activities
- Look to address institutional factors such as regulation and tax efficiency

A firm can also create a cost advantage by reconfiguring the value chain to alter the relationships between activities. Often, this implies removing activities that are not valuable. However, it can also lead to new production processes or distribution channels (Porter, 1985).

2.2.3.2 Differentiation and the Value Chain

Similar to cost advantages, a firm can get differentiation advantages by increasing the value and uniqueness of any part of its value chain. Differentiation ultimately arises when a firm adds value in a way that is unique to its competitors. As with cost advantages, the companies can get a differentiation advantage by changing the individual activities in the value chain to increase the uniqueness of the outcome or simply by reconfiguring the entire value chain. Porter identified nine specific drivers of unique value in the value chain (Porter, 1985):

- Changing policies and strategic decisions
- Improving linkages among activities
- Altering market timing
- Altering production locations
- Increase the rate of organizational learning
- Create stronger linkages between activities
- Develop relationships between business units
- Change the scale of operations
- Look to address institutional factors such as regulation and product requirements

Differentiation works in the opposite direction. Most of these factors can also serve as cost driver's differentiation works in the opposite direction. Differentiation increases cost with value. Therefore, cost control reduces costs to provide a lesser, or no, reduction in value. Similarly, the firm can reconfigure its value chain to create a unique value and differentiation. For example, a firm can forward integrate to provide its customers with more support or backward integrate to give it more control over the quality and uniqueness of its inputs, such as food companies insisting on organic sourcing. The firm can also use new process technologies or distribution channels, which create additional value for the end customer (Porter, 1985).

2.2.3.3 Technology and the Value Chain

Technology plays a specific role in the value chain. As technology impacts, all aspects of the value chain, investing in new technology research and implementation will provide additional value through improving the activities themselves or facilitating reconfiguration of the entire value chain. Indeed, companies use many technologies in the value chain, namely IT, mainly in supporting activities. As a result, by developing technology to support either a cost advantage or a differentiation advantage, businesses can produce a competitive advantage effect across their entire value chain (Kaplinsky & Morris, 2000).

2.2.3.4 Relationships between Value Chain Activities

Organizations cannot see value chain activities in isolation, and changes in anyone's value chain activity will have knock-on effects up and down the chain and in the support activities. For example, if a company reduces its inventory and minimizes warehousing costs, the resulting fall in raw material levels may cause production hold-ups (Porter, 2008). This activity can cause shortages which lead to marketing and sales of products. Any customer who receives a faulty product will also have a longer wait for a replacement, thus causing service issues and reducing overall customer value (Porter, 2012). If a company wishes to reduce its inventory levels, it must also improve its operational efficiency and ensure its marketing and service functions reduce the finished goods. Equally, sometimes, a firm may find that an improvement in one area has positive effects on another, such as when a firm uses technology to design a smaller product, reducing the demand for raw materials and warehousing requirements. These improvements are often crucial in developing competitive advantages. (Kaplinsky & Morris, 2000).

In addition, there are also likely to be relationships between the value chain activities of different business units, which can improve the advantages of all business units. Organizations may benefit from creating one function to purchase, store, and distribute that input to all business units. This process can help with a cost reduction, or the consistency of inputs into processes can create a single brand for all products, providing differentiation advantages. Unfortunately, real-life value chains are not as simple and often encounter issues that reduce or eliminate the expected benefits. For example, in the case above, creating a single purchasing

function may cause shortages if all business units find their demand increases and if there is any spoilage at the warehouse. (Walters & Lancastor, 2000).

2.2.3.5 Control of Value Chain Activities

A firm not only needs to decide what value chain activities to focus its efforts on the activities that are not critically controlled. For example, Coca-Cola keeps control of its marketing and part of its manufacturing operations. The rest of the manufacturing: mixing the syrup with carbonated water and the final distribution to retailers from the company's network of distribution partners. In contrast, BP carries out all activities, from exploration to extraction to refining to distribution and selling refined petrol through its petrol stations. Control a firm has over its supply chain is the vertical integration of the chain (Fernandes *et al.,* 2022).

A value chain analysis can help determine the company to control and devolve which functions to partners and outsource to third-party providers. However, managers should know whether partners or third parties will perform an activity better than the company itself. In addition, the firm needs to consider any risks associated with performing the activity in-house or outsourcing it, as well as the potential for business process improvements from using specialist partners or third parties (Fernandes *et al.,* 2022).

2.2.4 Supply Chain

Rabelo *et al*. (2003) define supply chains as life cycle processes to support the physical, information, financial, and knowledge aspects of moving products and services from suppliers to customers. Ketchen *et al*. (2008) define a supply chain as a system of people, activities, information, and resources involved in creating a product and then moving it to the customer. As the name implies, the primary focus on supply chains is upstream-pivoted, mainly on integrating supplier and producer processes, reducing waste and costs, and improving efficiencies of supply and the flow of materials from their various sources to their final destinations.

The goal of managing the supply chain creates value for both customers as high-quality products and the supply chain stakeholders as increased profits. Efficient supply chain

management will lead to bottom-line improvement or cost reduction (Feller, 2006; Rabelo, 2007).

2.2.5 Value Chain VS Supply Chain

The Value Chain has epitomized by Michael Porter 2006 as the combination of nine generic value-added activities that work together and are practiced within a company to provide value to customers. The value chain defines the amount buyers will pay for what the companies give. According to Houlihan (1987), the supply chain shows the value generates from the products and services. Al-Mudimigh *et al.* (2004), and Sun *et al.* (2007) later extended the definition of value to a broader extent:

- The customers perceived values rather than objectively determined by the seller;
- Value is a subjective experience that depends on the context and varies in the eyes of the beholder; companies generate business values by meeting the customer's needs and wants through their products. Also, the business value is an experience it flows from the customers.
- Value typically involves a trade-off between what the customers receive and what they give up to gain and use a product or service.

Dekker (2003) defined the value chain as the horizontal linked set of value-creating activities from fundamental raw material sources for component suppliers through the ultimate end-use product delivered to the customers. The primary focus in value chains is downstream- pivoted, mainly on the benefits that accumulate to customers, the interdependent processes that generate value, and the resulting demand and funds flow. A corporate value that has occurred from customer needs and wants that do not contribute to meeting these needs is considered "non-value-added" waste (Sun *et al.*, 2006).

Sarmiento *et al.* (2007) define supply chains as life cycle processes to support the physical, information, financial, and knowledge aspects of moving products and services from suppliers to customers. Hult *et al.* (2008) define a supply chain as a system of people, activities, information, and resources involved in creating a product and then moving it to the customer.

As the name implies, the primary focus in supply chains is upstream-pivoted, mainly on integrating supplier and producer processes, reducing waste and costs, improving supply efficiency, and the flow of materials from their various sources to their destinations. The goal of managing the supply chain is the creation of value for both customers; in the form of high quality products and the supply chain partners; in the form of increased profits. Efficient supply chain management will lead to bottom line improvement or costs reduction (Sarmiento *et al.,* 2007; Sun *et al.,* 2007 ;).

Integrated supply chains moving from supplier to customer and reverse logistics are known as Green Supply Chain Management (green value chain) (Zhu *et al.,* 2005). Similarly, when green purchasing, green manufacturing, green distribution, green marketing, and reverse logistics are the activities of Green Supply Chain Management (green value chain) (Chien & Shin, 2007).

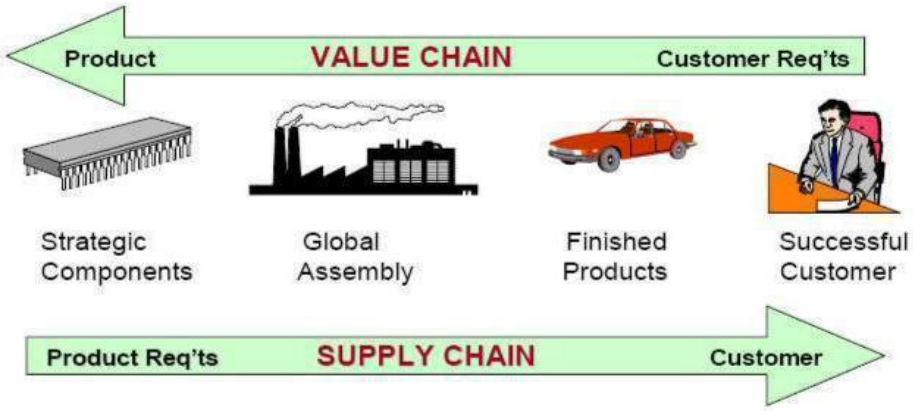

Figure 2.4:
Supply chain and Value chain (Source: Chien & Shin, 2007)

Table 2.2: Value Chain vs Supply Chain

Value Chain	Supply Chain
1 Combination of nine generic value added activities that work together and are being practicing within a company to provide value to customers (Baldwin, 2005).	1. The vertical linked set of value-creating activities between the firm and its buyers and suppliers (Dekker, 2003).

2 The horizontal linked set of value-creating activities from basic raw material sources for component suppliers through the ultimate End-use product delivered into the hands of final customers (Dekker, 2003).	2. A downstream flow of goods and supplies from the source to the customers (Feller, 2006).
3 Concerned primarily, with the customer from start to finish whereby supply chain becomes only a subset to value chain (Al-Mudimigh, 2004).	3. Life cycle processes to support the physical, information, financial and knowledge aspects for moving products and services from suppliers to customers (Sun *et al.,* 2007)
4 An upstream flow of value, in the form of demand, from customers to supplier (Sun *et al.,* 2007)	4. A system of people, activities, information and resources involved in creating a product and then moving it to the customer (Hult, 2008)
5 A traditional production or assembly supply chain with added component of service (Sarmiento *et al.,* 2007)	5. Tool to manage value created (Houlihan, 1987)

(Source: Developed by author)

Many authors have summarized these various definitions presented in Table 2.1. Based on the preceding discussion and by integrating the salient concepts of all authors, the value chain can be redefined as an upstream flow of value, in the form of demand or specifications, from customers to suppliers via both the horizontal and vertical linked-set. The supply chain is a flow of value created from the source of product and service to the customers via horizontal and vertical linked sets (Porter, 1985; Porter, 2015; Taylor, 2005).

Green value chain and green supply chain can be created by considering the mitigation plan to allay the environmental aspect and impact (Tsai & Hung, 2009). The researcher referred to these definitions throughout the entire research study. Antecedents of green value chain: today,

the companies face increasing demands from various stakeholders concerning the environmental performance of their products and processes, whereby public authorities demand companies' environmental performance to comply with legal and other requirements, and customers are asking for green products, employees and neighborhood residents are concerned about the health and safety aspects of production and non-governmental organizations are pressing companies for sustainability (Pesonen, 2001). Futuremore, sustainable competitiveness is therefore closely dependent on as to what extent the manufacturing companies are greened and being environmentally friendly (Darmawan *et al.,* 2014).

2.2.6 Drawbacks of the value chain

The value chain constructed by Micheal Porter (1985) was intended as a method of mapping and identifying how the critical activities of an organization came together harmoniously to generate sustainable value creation for all stakeholders (Sun *et al.,* 2007). The value chain was proposed by Micheal Porter (1985) as a process mapping that enabled the organization to constantly view each of the individual activities under the sub-sections and make them more efficient and cost-effective to drive profit margins (Taylor 2005). However, modern business is a social responsibility, and the impact of transparency through social media pays attention to the businesses that can no longer look to merely be profitable by improving the efficiency of the activities within their value chain (Weber, 2008).

McCormick *et al.* (2007) suggested that companies must incorporate the value chain with the customer segment analysis to integrate the internal and external views. McCormick *et al.* (2007) also stated the fact to underpin the premise that a feature or product provides a competitive advantage to the organization only if the priority customers are willing to purchase. McCormick *et al.* (2007) emphasized that creating customer value gives rise to a new concern about customers being just as concerned with the environmental impact of manufacturing a product as they are with ensuring value for money. The new dynamics of business operations focus on companies being more socially responsible about all the work and the environmental impact. By this definition, the cost of operations can generally increase, but the organization remains tenable as they meet stakeholder expectations (Weber, 2008).

2.2.7 Key Elements in the Cement Industry Value Chain

Like any industry, the cement industry has critical activities to its functionality and the ability to deliver value to its customers. These activities also generate the maximum amount of direct and indirect pollution to the environment (Tennis *et al.*, 2011).

Manufacture: - The cement production conducts through a specific operations process in the chemical mixture of the percentage of cement clinker ratios. There is a direct correlation between the proportion of clinker and the number of carbon emissions by heating limestone. A lower rate of cement clinker known as a lower ratio of limestone that converts in the kiln is the operational aspect of the value chain (Tennis *et al.*, 2011).

Transportation: - The transportation of limestone is a vital aspect of the value chain in a cement mill. The carbon emission is massive when transporting limestone and other materials such as gypsum (Tennis *et al.,* 2011).

Packaging: - The use of large volumes of paper as a packaging material contributes to a negative impact on the environment. Bags are not recyclable because they are biodegradable. (LafargeHolcim, 2015).

Financial Operation: - The overall cost of manufacturing the product is vital. Government legislation controls the retail price of cement through a price ceiling. The restriction on selling price is a constraint on the financial operations of the business as the operational activities to be conducted within an extremely tight budget to maintain a meaningful profit margin to meet shareholder expectations (LafargeHolcim, 2015).

Organization Behavior: - How the culture, skill, structure, and knowledge of the organization have evolved to behave in a specific manner and conduct the activities o the value chain (LafargeHolcim, 2015).

2.2.8 Green Value Chain Concept

The growing importance of managing environmental concerns that arise from primary stakeholders has become one of the most significant aspects for senior management and value chain managers (Tan & Zailani, 2009). These individuals focus on re-evaluating the activities conducted in the value chain due to the close relationship between the value chain and the environmental footprint the company provides green value chain has become a significant element that organizations now use as a form of sustainable operations to establish a competitive advantage within many industries (Srivastava, 2007 & Weber, 2008).

Gandhi et al. (2015) states that organizations focus on environmental management systems as it enables them to achieve the following advantages in operations.

- Obtaining competitive advantages
- Procuring government incentives and the support of regulatory authorities
- Clean and green operation
- Effective operations that increase profitability over some time.
- Creating a unique product that customers will value-creating opportunities for market expansion
- Improving the company and corporate image
- Satisfying stakeholder expectations

Organizations being more responsible has resulted in a significant change in the value chain through its stages of evolution that have now come to rest on the green value chain (Muduli *et al.*, 2013). According to Gandhi *et al.* (2015), a green value chain will lead to sustainability as it will create a Win-Win Alliance with stakeholders that will allow organizations for a positive image in the minds of the stakeholders as being socially responsible. Greening the value chain will also increase the organization's efficiency. Removal of unnecessary inventory movements and coefficient operations increases productivity towards achieving sustainable competitive advantage. These factors lead to enhance profits (Weber, 2008).

2.3 Overview of Green Value Chain Adaptation and Sustainability

Organizations use primary and secondary activities to gain competitive margins through customer value creation (Porter, 1985). Modern customers are only concerned about the production method and the environmental impact as they are with ensuring value for money. The dynamics of business operations focus on companies being more socially responsible for the ecological consequences. The cost of operations can generally increase, but the organization remains tenable as they meet stakeholder belief (Weber, 2008). The value chain has been reshaping with different adaptations as part eh global trends and stakeholder requirements, while environmental pressure is quite significant in this context.

Green value chain management first appeared in 1982. SCM describes the logistic management between organizations, and its development divides into three stages: functional management, internal management, and external integration (Master, 1994; Langley, 1992. Some top journals focus on service operation management in the 1990s (Lü, Geng, 2015). Research on SCM has shifted to using a complex approach to maximize profits or minimize costs. For example, SCM has integrated with the sustainable development concept to create many new trends in the academic field. In 1987, the Brundtland report popularized sustainable development. The World Commission on Environment and Development –WCED, (1983): convened by the United Nations: addresses the growing concern about the consequences of the accelerating deterioration of the human environment and natural resources. Many studies have been named the Brundtland Report in recognition of the chairman of the WCED, Gro Harlem Brundtland. It identified the concept of sustainable development, which meets current development needs while not prejudicing our offspring to meet their needs. Since the Brundtland report was published, sustainable development has recently spread to various research areas, and the sustainable development of green value chain management has become a focus. With the continuous theoretical and practical expansion that began in the 1990s, green and environmental issues began to obtain widespread attention, and traditional green value chain management began to the concept of sustainable development, forming sustainable green value chain management (Chien & Shih, 2007).

Chien and Shih (2007), and Linton (2007) proposed Sustainable green value chain management. Afterward, many scholars carried out related studies. Some researchers have defined the term sustainable green value chain from the level of management and economic

profit, including Securing (Carter & Roger, 2008; Mueller, 2008). Recently, the research on green value chain management has shifted from reverse or close-loop green value chain to a green value chain or sustainable green value chain management based on a triple Bottom Line (TBL). TBL is an integrated concept of the social, economic, and environmental bottom line. Nowadays, the triple bottom line focuses on sustainable service green value chain management (SCM) and optimizes the whole service green value chain (Chien & Shih, 2007). At the same time, during the economic globalization process, the service industry has increased quickly, and its contribution to economic growth is increasingly obvious. Ellram (2004) has defined the service green value chain which refers to a new green value chain including information management, process management, competency management, service performance, and treasury management that occurs in professional services, from the upper stream supplier to the downstream customer. Nowadays, the definition of service green value chain has been extended, which includes service only green value chain (Chien & Shih, 2007).

In the aspect of a green value chain, Shabbir and Kabir (2018) define a green value chain system as "a network of suppliers, service providers, consumers, and other supporting units that performs the functions of transactions of resources required to produce services; transformation of these resources into supporting and core services; and the delivery of these services to customers". Khaksar *et al.* (2016) define an application of a green value chain as a system composed of three parties: the service producer for infrastructure, the retail service provider, and the customer. In the real world, industries namely; finance, telecommunication, internet service, mobile apps, and tourism. Different managerial contexts of the green value chain manage physical products with significant service considerations. Thus, there are both "services" and "physical products" in these green value chain systems. Arguably, there are more s than s explored in the literature. For example, we can find s in restaurant and food retail green value chain (Chien & Shih, 2007). Product design and retailing green value chain, logistics green value chain, and hotel green value chain (Chien & Shih, 2007; Liu *et al.*, 2016; Sampson & Spring, 2012; Wang *et al.*, 2015).

Camarinha-Matos *et al.* (2003) define a green value chain as life cycle processes to support the physical, information, financial, and knowledge aspects of moving products and services from suppliers to customers. According to Hult *et al.* (2008), the green value chain is a system of people, activities, information, and resources involved in creating a product and then moving

it to the customer. As the name implies, the primary focus in the green value chain is upstream-pivoted, mainly on integrating supplier and producer processes, reducing waste and costs, improving efficiencies of green value, and the flow of materials from their various sources to their final destinations. The profit increased with value creation for customers in the form of high-quality products and green value chain partners. Efficient green value chain management will lead to bottom-line improvement or cost reduction (Loss *et al.,* 2008; Sun *et al.,* 2006). The value chain concept epitomized by Porter (2008) defined value chain as the combination of nine generic value-added activities that work together and are practiced within a company to provide value to customers.

The value of Michael Porter's competitive advantage framework considers the amount buyers are willing to pay in return for what a company provides. According to Chien and Shih (2007), and Houlihan (1987), the value is created and managed through the green value chain. Al-Mudimigh *et al.* (2004), and Sun *et al.* (2007) have extended the definition of value to a broader extent. Dekker (2003) defined the value chain as the horizontal linked set of value-creating activities from raw material sources for component suppliers through the ultimate end-use product delivered to the final customers. The primary focus in the value chain (Chien & Shih, 2007) is downstream- pivoted, mainly on the benefits that accrue to customers, the interdependent processes that generate value, and the resulting demand and funds flow. Non-value-added waste is the value derived from customer needs and activities that do not contribute to the meeting (Sun *et al.,* 2007).

A manufacturing system aims to constantly reduce costs and increase value-added to its products and services by continuously improving the material transformation process. An efficient value chain will eventually result in top-line growth or profit generation (Chien & Shih, 2007; Liu *et al.,* 2016; Sampson & Spring, 2012). In addition to these underlying traditional dimensions, the value chain connotation has evolved, been refined, and expanded to include environmental aspects. The newly transformed concept manifested as a green value chain (Chien & Shih, 2007). Environmental strategies must be integrated into all stages of the value chain to be successful with environmentally friendly practices (Chien & Shih, 2007and Loss *et al.* (2008). According to Loss *et al.* (2007), a green value chain is a set of life cycle processes that support the physical, information, financial, and knowledge aspects of moving products and services from suppliers to customers. According to Hult *et al.* (2008), a green

value chain is a system of people, activities, information, and resources involved in creating a product and then delivering it to the customer. The primary focus of the green value chain, as the name implies, is upstream, primarily on integrating supplier and producer processes, reducing waste and costs, improving green value efficiencies, and the flow of materials from their various sources to their final destinations.

According to Al-Midimigh *et al.* (2004), value chain management connects with the customer from start to finish, whereby the green value chain becomes only a subset of to value chain. Sun *et al.* (2007) summarized the relationship between a value chain and a green value chain. As complementary views of an extended enterprise with integrated business processes, which enable the flows of products and services in one direction, while value is represented in terms of demand and cash flow in other direction. For ease of reference, the various definitions are denoted by different authors. Based on the preceding discussion and incorporating the fundamental concepts of all authors, the value chain redefines as an upstream flow of value from customers to suppliers via the horizontal and vertical linked sets (Liu *et al.*, 2016; Sampson & spring, 2012). The green value chain is a downstream flow of value created as a product and service from the source to the customers via the horizontal and vertical linked-set. A green value chain considers the mitigation plan to alleviate the environmental aspect and impact (Sampson & spring, 2012; Wang *et al.*, 2015).

Companies are facing increasing pressure from various stakeholders to improve the environmental performance of their products and processes. Public authorities emphasize companies' environmental performance to comply with legal and other requirements. Customers want green products, employees and neighbors are concerned about the health and safety aspects of production, and non-governmental organizations are pressuring companies to be more sustainable (Kwon *et al.*, 2001). Future sustainable competitiveness is thus closely related to the extent to which manufacturing firms are green and environmentally friendly. Porter (1985) developed the value chain as a method of mapping that identifies how an organization's critical activities came together harmoniously to generate long-term value creation for all stakeholders (Sun *et al.*, 2007). The value chain is a process mapping that allows the organization to constantly view each of the activities within the sub-sections and make more efficient and cost-effective decisions to increase profit margins (Taylor, 2005).

According to Camarinha – Matos *et al*. (2003), the green value chain a life cycle process to support the physical, information, financial, and knowledge aspects of moving products and services from suppliers to customers. Hult *et al.* (2008) define a green value chain as a system of people, activities, information, and resources involved in creating a product and then moving it to the customer. As the name implies, the primary focus in the green value chain is upstream-pivoted, mainly on integrating supplier and producer processes, reducing waste and costs, improving efficiencies of green value, and the flow of materials from their various sources to their final destinations. The goal of managing the green value chain is to create value for both customers; in the form of high-quality products and the green value chain partners; in the form of increased profits. Efficient green value chain management will lead to bottom-line improvement or cost reduction (Loss *et al.,* 2007; Sun *et al.,* 2007). The value chain concept indicates the combination of nine generic value-added activities that work together and are practiced within a company to provide value to customers. Value, within the context of Michael Porter's competitive advantage framework, is the amount buyers are willing to pay in return for what a company provides. According to Foster *et al.* (2011), the value created is then managed (Chien & Shih, 2007). Al-Mudimigh *et al.* (2004) and Sun *et al.* (2007) extended the definition of value to a broader extent. Loss et al. (2008) defines green value chain as life cycle processes to support the physical, information, financial, and knowledge aspects of moving products and services from suppliers to customers. Hult *et al.* (2008) define the green value chain as a system of people, activities, information, and resources involved in creating a product and then moving it to the customer.

In the modern business world, the social responsibility and the impact of transparency through social media have caused huge concern for companies that can no longer look to merely be profitable by improving the efficiency of the activities within their value chain (Chien & Shih, 2007; Weber, 2008). There is a drawback in its ability to critically account for the pressures of the social environment that influence the organization's capability to maintain its profit margin. McCormick *et al.* (2007) referred to this aspect when they indicated that organizations need to work beyond developing a competitive advantage by efficiently conducting their internal activities that consider the impact these activities have on society. Johnson *et al.* (2012) made explicit reference to the drawbacks of many activity-based analysis tools to which the value chain categorizes by stating that organizations need to establish successful strategies of business operations that formulate around the consideration of the social, environmental, and

financial aspects of the business. This element differs from Porters' theory that each activity needs to be conducted at its highest level of efficiency to make the business profitable (Dhull & Narwal, 2016).

According to Khaskar *et al.* (2016), the value chain should include customer segment analysis to integrate internal and external perspectives. The main objective of this recommendation is to bolster the idea that a company can only benefit from a feature or product if priority consumers are willing to pay for it. It introduces a new area of worry because modern consumers are just as concerned with a product's creation and environmental impact as they are with getting the best value for their money. The new business dynamics emphasize companies being more socially responsible in all aspects of their operations, including the environmental impact. According to this definition, the cost of operations can generally rise, but the organization remains viable as long as it meets stakeholder expectations (Weber, 2008).

The cement business, like any other, has distinct operations that are crucial to its functionality and capacity to give value to its clients. The activities produce the most direct and indirect environmental pollution (Tennis *et al.,* 2011). Manufacturing: -The specific operations process in the chemical combination of the percentage of clinker ratios to generate cement as clinker produces by heating limestone, the base raw material, the proposition of clinker in the mixture is directly proportional to the number of carbon emissions. The lower proportion of clinker means a lower ratio of limestone converted to clinker in the kiln. In the cement industry, operational factors comprise some critical components, and many organizations strive to incorporate green practices into those aspects to achieve long-term results. As a result, the transportation of quarried limestone to the cement mill is a significant part of the operations process and is a critical component of the value chain (Chien & Shih, 2007). The limestone and other products, such as gypsum, are transported in huge trucks, which release five times as much carbon dioxide as a passenger vehicle (Tennis *et al.,* 2011). When vast amounts of paper are used for packaging material, it negatively affects the environment. Bags are not recyclable, despite being biodegradable (LafargeHolcim, 2015). The overall production cost is critical as the retail price of cement controls by government legislation via a price ceiling. The limitation on selling price is a constraint on the business's financial operations, requiring operational activities to be carried out within an extremely tight budget to maintain a profit margin to meet shareholder expectations (LafargeHolcim, 2015). Human resource practices include the social responsibility that makes out the organization's culture, skill, structure, and knowledge have

evolved to behave in a specific way and conduct activities following the value chain (LafargeHolcim, 2015). The process has been concerned with the growing importance of dealing with environmental issues that arise from primary production.

Because of the close relationship between the value chain and the environmental footprint that the company contributes, these individuals focus on re-evaluating the activities performed in the value chain (Weber, 2008). The green value chain is a significant component to an organization as a form of sustainable operations to gain a competitive advantage in different industries (Foster *et al.,* 2011). According to Gandhi *et al.* (2015), a green value chain will lead to sustainability as it will create a Win-Win Alliance with stakeholders that will generate a positive image in the minds of the stakeholders as being socially responsible. However, greening the value chain will also increase the organization's efficiency and sustainable competitive advantage by increasing profits. The organizations will be able to reduce waste in all aspects and will finally increase profitability (Weber, 2008).

Many kinds of literature executed theoretical and practical models as remedial to the existing situation of environmental damage need to be designed within the supply chain activities to address the green value creations (LafargeHolcim, 2015; Zhu & Sarkis, 2012). Such a design must study with a quantitative and a deductive survey to ensure the model fit. From the literature, it is evident that integrating environmental practice in organizational activities has become an irreversible reality to remain and satisfy wider stakeholders.

Greening the SCs is the innovation to achieve competitive advantage. Green value chain practices require time, capability, commitment, and investment. However, firms usually initiate specific applications as long as business gains are involved. There are specific drivers and pressures in the literature broadly categorized as pro-active and reactive drivers by somsuk and Laosirihongthong (2017); coercive and no coercive drivers by Tachizawa *et al.* (2015); internal and external drivers by Lu *et al.* (2016), Testa and Iraldo (2010), Vencho and Klassen (2007), and Zailani *et al.* (2012) and so on. Firms get stimulation from the various sources of drivers and pressures to practice a green value chain in their operations. Due to external pressures (regulations, competition, and customer expectation) and internal driving forces such as commitments from top management based on organizational values, support from mid-level

managers and senior employees, and expected business gains, companies are institutionalizing environmental practices in business operations.

Hence, this study used the institutional theory evaluate the green value chain. Many organizations practice green value chains as internal environmental management, green purchasing, Eco designing, investment recovery, and cooperation's (Zhu *et al.,* 2012). There are inconclusive arguments in the literature about whether green value chain practices improve performances or not have evidence from both positive and negative performance outcomes (Green Jr *et al.,* 2012; Laari *et al.,* 2016; Rao & Holt, 2005; Zhu & Sarkis, 2005). There were different components in measuring firm performance in the previous studies. Tseng *et al.* (2015) claimed that green value chain practices and organizational performance is unlikely to perform well without depending on the green value chain (Chien & Shih, 2007). Due to the resource scarcity including technological know-how, knowledge and expertise, and human and financial resources (Lee *et al.,* 2012; Huang *et al.,* 2015), the organizations are dependent on the partners in their green value chain (Chien & Shih, 2007). To minimize risks and complexities in their green value chain (Chien & Shih, 2007), inter-firm dependence to improve firm performance become inevitable. Hence, resource dependence theory was used in this study to understand performance implications. In this study, the researcher measured performance considering operational efficiency, brand image, and profitability.

2.4 Environment Innovation in Business Processes

Environmental innovation is the eco-management of economic activities by corporations and affects performance through continual improvement (Foster *et al.,* 2011). Innovation and environmental management approaches reshape an operational structure (Morrow & Rondinelli, 2002). Environmental innovation should be related to the event of an environmental strategy, employee coaching, continual measure of environmental impact, and environmental audits (Morrow & Rondinelli, 2002; Zhang & Cao, 2002). The cement and concrete industry has grown to become giant contributors to the world economy in all countries. This industry provides vital jobs, governmental revenue, and economic growth options. The cement industry has realized that modern life would be impossible without the use of cement and concrete. With the global population approaching 8 billion people, it is reasonable to expect more infrastructure, housing, and business development to revolve around cement consumption. This study postulates that the green-focused value process of an organization could facilitate

environmental innovation activities (Darnell & Edwards, 2006; Deming, 1986; Hansen, 1995; Morrow & Rondinelli, 2002; Zhang & Cao, 2002).

CEMBUREAU (The European Cement Association) published a report on Cement 2050 Low Carbon Economy in 2014. The primary resource used to produce clinker provides industry CO2 diffusions of up to 60%, resulting in the direct transfer of limestone to lime. In the CEMBUREAU 2015, the typical clinker-to-cement ratio is 73.7%, while in Europe and the Middle- East is 70%. In addition, the resources such as fly ash, slag, or silica fumes reduce the clinker-to-cement ratio by 70%, resulting in a global CO2 savings of 4%. Sri Lankan cement production predominantly considers in all types of construction, including concrete blending. Holcim dominates the cement industry. (LafargeHolcim, 2017).

Environmental innovations result from important sustainable outcomes for an organization which include reshaping the production functions, minimizing energy use and wastage, minimizing pollution, and finally adding value to the overall model of the business process (Cheng & Shiu, 2012). These improvements have the potential to improve firm performance via cost reduction and increased productivity and efficiency (Shrivastava, 1995). It is preferred that getting competitive advantages via environmental innovation is challenging unless the firm has taken initiations for proper information management and quality consistency within the internal process (De Marchi, 2012). Environment innovations taken by a firm can enjoy sustainable results via environmentally friendly products resulting from a green manufacturing process. It generates innovations and customer value creation, which result in firms getting advantages on improved product quality and product price premium, which lead to market share. Moreover, environmental innovations provide room to entertain the firm's image and stakeholder satisfaction as sustainable performances (López-Gamero *et al.*, 2009; Molina-Azorín *et al.*, 2009).

However, empirical arguments are there to justify eco- innovations act as mediating roles when firms initiate environment management activities aiming for sustainable results or performances. Environment management functions and the firm’s operations are looked like indirectly confirmed relationships, whereas the degree of environmental innovations taken by a firm enhances it (Molina-Azorín *et al.*, 2009). Studies argue and propose to examine the mediating role of environment innovations when firms implement strategies with environment friendly value process to achieve competitive performances (Boons & Wagner, 2009;

Christmann, 2000). The cement industry of Sri Lanka has to be serious about investigating how its environmental innovations could enhance the strategic results expected through the green value process. Overall, this review provides a rationale to examine environment innovation as a mediating mechanism while its direct relationships with firm sustainable performances and green-friendly functions proved empirically supported (Boons & Wagner, 2009; Christmann, 2000; McWilliams *et al.,* 2000).

2.5 Sustainability and Firm Performance

Corporate Sustainability is an interrelated matter between business goals and environmental conservation (Lovins *et al.*, 1999). Environmental friendly business models could create competitive advantages for a firm leading to better financial performance verifying how suitability links with the overall performance of a firm (Darnall *et al.,* 2008; Engardio, 2007). The business processes connect with the environment with climate changes, recycling, and energy conservation, which link to performance subsequently (Khan & Qianli, 2017).

For instance, Weber (2017) revealed how construction projects conduct defects without a superior philosophy and successful management with an impact of environmental factors determining the performance of those projects. Some research suggested that stakeholders should take knowledge of the variables under these three clusters for proper management and prevention of cost and time overruns. Andrée *et al.* (2021), and Mishra and Napier (2015) elaborated on double-skin façades and complicated the motorized shading systems masking a lack of basic environmental philosophy. This article returns to the physics of comfort in buildings and the static strategies which can help achieve this with a low energy and carbon footprint. Architecture and environmental thinking can proceed hand in hand through the design process for sustainable businesses (Martin *et al.,* 2017). Mahdi *et al.* (2015) mentioned how climatic change impacts the construction project lifecycle. Climate change is over time depending on high confidence evidence through the scientific. Now construction industry is facing one of the challenging climate change factors. As no project is risk-free and climate change, the construction project lifecycle is affected by the strong impact in different phases. Wang *et al.* (2016) discussed a platform specialized for construction management practitioners about the impacts of climate change on the construction project lifecycle. The study also emphasizes the most dangerous climate change factors in construction projects. Thus, it proves the industries are concerned about the environmental impact of the business process and take

measures to determine the performance accordingly. Meanwhile, Chen (2016) explained how climate change has been considered by experts among different management and adjustments when meeting the issues of climate to chive performance. Studies indicate that climate change concerning sustainable business processes and outcomes. Sabunas and Kanapickas (2017) evaluated how climate change expects to have on the energy performance of a residential building in Kaunas, Lithuania, essentially due to changes in heating and cooling demand. Energy efficiency was one of the performance highlights of those environmental business models.

There is clear evidence that the global climate is changing (Kung *et al.,* 2012; Golicic & Smith, 2013). In order to limit the risks caused by a rising sea level rise or extreme weather events, Adaptation to climate change is necessary. At present, governance strategies to a large extent focus on policymaking at the national and municipal levels, not taking into account the policy level of property owners. However, they are the actors that are in the position to commission physical Adaptation activities for the construction sector that is responsible for the actual application of physical measures to buildings. Moreover, the construction sector itself is struggling with the negative effects of its inherent fragmentation, causing disadvantages such as miscommunication, long lead times, and extra costs, and it hampers innovation (Davey-Wilson, 2001). The existence of this fragmentation in the construction sector can be clarified by the pivotal position of a building, between a network of stakeholders (owner, user, financer, etc.) on the demand side and a network of actors (designer, contractor, industry, etc.) on the green value side (Vrijhoef, 2011).

Moreover, both the demand- and green-value side networks have their fragmentations. On the demand side of the stakeholders, the owner wants a building that meets the needs, the financer wants a specific return on investment. Green value is necessary for enhancing competitiveness (Dulaimi *et al.,* 2002). Efforts have been made to bring about better integration, by adopting a partnering approach to align the differences in goals and values that originate from the present procurement methods and contracts (Bankvall *et al.,* 2010 and Bresnen & Marshall, 2000). Thus, it is clear to argue eco-friendly business activities still need more investigations to examine how those functions generate sustainable outcomes.

Empirical justifications are fund claiming to investigate the environment sustainability in terms of less use of resources, waste management, less pollutions as value addition options within

business operations (Schmidheiny & Timberlake, 1992; Lovins, *et al.,* 1999). The connection of sustainable practices for business performances explained via profits and competition is empirically explained to investigate in different business fields, whereas Sri Lankan cement manufacturing giants highlighted the same matter (LafargeHolcim 2017; Sinding, 2001). Economic impact and the competitive advantages of sustainable business strategies had been further mentioned and claimed to investigate in different contexts (Lash and Wellington, 2007; Aifuwa,2020). Specially manufacturing companies have to adopt to suitable practices and revitalize the value chain as a green process due to resource limitation, rules, government pressures and social pressures come from stakeholders (Sharma & Ruud, 2003). Sri Lankan manufacturing firms are also adopting such green-friendly business models due to such pressures and resource issues, including unique philanthropies, whereas the manufacturing and construction sectors of Sri Lanka play a critical role in the economy (Central Bank of Sri Lanka,2017; Central Environment Authority of Sri Lanka, 2017). The cement manufacturing sector of Sri Lanka is mainly dominated by two companies, whereas Holcim leads the process, and it has taken substantial measures within its value chain than green activities, while a lot of community services and CSR activities as a global company (LafargeHolcim, 2017). In overall, it is said the green friendly products have increasing demand and consumers tend to respond positively towards those (Laskar & Maji, 2018). Sri Lankan cement manufacturing companies apply the same procedures to provide a green-friendly product. However, the challenge is how the system rewards the overall performance. Conclusively, sustainability and the measurements of its outcome for a firm discuss supply chain activities, green production outcomes, the effectiveness of the business strategy, the green behavioral response of the customers, waste management, competitive advantages, and the firm profitability or financial gains (Alhaddi, 2015; Berman *et al.*, 2002; Catulli, 2006; Conelly & Limpaphayom, 2004; Holweg & Pil, 2001; Salvador *et al.*, 2002; Sharma & LaPlaca, 2005).

2.6 Justification on Application Green Supply Chain Management (Green Value Chain) within Green Value Creation.

Sustainable or green Supply Chain Management (SCM) has been an ever increasingly researched area for decades (Sarkis, 2012; Touboulic and Walker, 2015) and a key challenge (Maradani *et al.,* 2015). Green value chain Management strategies such as environmental thinking in SCM activities have gained popularity in academia (Adebanjo *et al.,* 2013; Ahi & Searcy, 2013) due to environmental degradation, increased CO2 emissions, and climate change threatening human existence and natural inhabitants (Venken *et al.,* 2011). Lee (2015) mentioned that these challenges come from global environmental regulations, green consumerism, and climate change. Organizations are compelled to rethink managerial behavior towards green practices including implementation of environmental audits, maintaining certifications such as ISO 14001, and collaboration with stakeholders (Hollos *et al.,* 2012).

However, organizations will prefer the options which make sense for businesses (Bowen et al., 2001). Much of the debate on GVCM is to determine the drivers, motivations, or pressures in undertaking GVCM initiatives (Diabat & Govindan, 2011; Govindan *et al.,* 2014) and its influences on organizational performances (Green et al., 2012; Laosirihongthong *et al.,*2013 Lee *et al.,* 2012; Lee, 2015, Zhu *et al.,* 2012). There is also growing research on the role of the green value chain collaboration on sustainability (Dubey *et al.,* 2017 and Gunasekaran *et al.,* 2015; Ramanathan *et al.,* 2014; Vachon & Klassen, 2007). However, there have been limited studies on SCM practices of Small and Medium-Sized Enterprises (SMEs) (Quayle, 2003; Rahim *et al.,* 2016; Sevkli *et al.,* 2007; Thakkar et al., 2009; Vaaland & Heide, 2007). Few studies on green value chain practices of SMEs and no research has been found on UK food retail SMEs that have a particular focus on the green value chain. (Aragon-Correa *et al.,* 2008; Huang *et al.,* 2012; Huang *et al.,* 2015 Lee *et al.,* 2012; Kumar & Chandrakar, 2012).

There is a substantial gap in the literature. This research attempts to fill the gap by identifying existing green value chain practices and their impacts on the performance of UK Food retail SMEs. Integrating environmental thinking into supply chain management is becoming a strategic issue for businesses to satisfy the stakeholders in the SC. It is fundamental for organizations to implement green value chain practices to generate competitive advantages and cope with increasing environmental regulations (Green *et al.,* 2012). Developing and implementing green norms and processes require a specific motivation or driver. Drivers may come from the organization or an external source, for instance, government, environmental

agencies, market forces, and customer expectations. This study highlights the perspective of institutional theory. The implementation of green value chain practices improves the business performance of organizations, and enhances brand image, which will ultimately enhance profitability. Green *et al.* (2012) claimed that whether green value chain pays has been inconclusively investigated in the previous research (Rao & Holt, 2005; Zhu & Sarkis, 2004). Therefore, there is a dearth of research in this area that can use as a base for either theory building or theory testing (Green *et al.,* 2012). Examining how UK food retail SMEs practice the green value chain and the impact on the performance outcome is essential because approximately 99% of businesses fall under SMEs in the UK (Walker & Preuss, 2008; Ward & Rhodes, 2014). The recent horse meat scandal in the UK has triggered a massive corporate storm throughout the SC of every food green value network. Companies ensure to make supply chains more transparent and visible to achieve consumers' confidence and avoid reputational damage (Carter and Rogers, 2008; Touboulic & Walker, 2015).

Food SCs, in one way or another, significantly depend on SMEs. The SMEs can be motivated to take purposeful action in greening supply chains, likely, the problems such as CO2 emissions from food SCs will significantly be reduced. However, proper attention has not yet been given to researching green value chain management practices in SMEs and even less to the impact on firm performance. Green value chain management which considers environmental issues is the extension of traditional supply chain management. Mahmood *et al.* (2013) defined green value chain as the linked operations to source and provide goods and services to the end users. The green value chain follows similar activities but in a way that is more innovative, profitable, widely acceptable, socially and environmentally responsible (Sarkis *et al.*, 2011; Zhu *et al.*, 2012). The reviewed literature indicates that scholars have used different terminologies to comprehend the green value chain over a period of time, for instance, cleaner supply chain management (Subramanian & Gunasekaran, 2015), sustainable green value chain management (Ahi & Searcy, 2013; Beske *et al.*, 2014; Linton *et al.*, 2007; Seuring & Müller, 2008; Touboulic & Walker, 2015), environmental supply chain (Jabbour *et al.*, 2015), green practices of supply chain (Azevedo *et al.*,2011), and socially responsible supply chain (Hoejmose *et al.*, 2013).

Many scholars have tried to define the green value chain from various perspectives. Tachizawa, *et al.* (2015) classified monitoring-based and collaboration-based green value chain practices.

Testa & Iraldo (2010) identified three different strategic perspectives illustrated green value chain such as reputation-related, efficiency-related, and innovation related. Azevedo *et al.* (2011) recommended green value chain practices as greening the green value process, product based practices, delivery process, and green practices through cooperating with suppliers and customers. Though the views are not identical, the notions are similar. Evaluation of the green value chain is historical. Its dimensions, definitions, and level of acceptance have changed significantly since it first emerged in the practical and academic domains. There are some subtle and few differences among the terminologies used to denote green value chain or sustainable supply chain management such as the definitions, scopes, and characteristics of the practices (Min & Kim, 2012). Ahi & Searcy (2013) have attempted to distinguish the definitions between a green value chain and sustainable supply chain management claiming that sustainable supply chain management is the extension of a green value chain. There is considerable overlap among the definitions. However, Ahi & Searcy (2013) could not identify any complete definition for either green value chain or sustainable supply chain management.

The green value chain is the mix of environmental, societal, and economic considerations in a green value chain that operates as linked activities starting from sourcing raw materials to post-consumption activities. However, the motivating factors for adopting green value chain practices in the UK SME sector (Sarkis, 2003). Organizations practice green value chain proactively or reactively (Laosirihongthong *et al.*, 2013). Those driving forces can be from within the organization (internal) or outside the organization (external). Many researchers Testa and Iraldo (2010), Wang *et al.* (2013), and Zailani *et al.* (2012) maintain the view that internal drivers and external pressures induce organizations to practice a green value chain. However, Laosirihongthong *et al.* (2013) mentioned reactive pressures and proactive drivers instead of internal factors, and external factors that drive firms to practice green value chain management. Tachizawa *et al.* (2015) distinguished coercive (regulations and environmental standards) and non-coercive drivers for green value chain practices. Some of the organizational theories, such as the resources-based view, resource dependence theory, and institutional theory, help to understand how firms succeed in implementing specific operations strategies (Laosirihongthong *et al.*, 2013; Lee *et al.*, 2012; Sarkis *et al.*, 2011; Wang *et al.*, 2013).

Diverse entities in the green value chain act to fulfill business needs, customer expectations, and legitimate requirements. Businesses receive pressure from regulatory bodies and increased

influence from customers for a cleaner, transparent, socially and environmentally responsible Green value chain (Zailani *et al.*, 2012). Due to these pressures from outside and driving forces from within the organization, such as organizational values, corporate commitment, and long-term vision, companies are institutionalizing environmental practices in business operations (Hsu & Hu, 2008). In this sense, the institutional theory is suitable for understanding the phenomena. Moreover, several studies have identified institutional theory as a fundamental source that influences the practice of a green value chain (Sarkis *et al.*, 2011& Zhu & Sarkis, 2007). Hence, this study focuses on institutional theory to understand the motivating factors of green value chain practices. Based on institutional theory, Dimaggio and Powell (1983), and Sarkis *et al.* (2011) highlighted three isomorphic drivers of the green value chain as Coercive pressures – governments, environmental interest groups, and industrial associations; Normative pressures - social pressures, consumer expectation, communities and wider stakeholders (Seuring & Müller, 2008); and Mimetic - coping the activities of a successful organization and competitive benchmarking. The higher the coercive pressure is, the higher the tendency of the firm to practice a green value chain (Testa & Iraldo, 2010; Zhu & Sarkis, 2007). For instance, in order to avoid legislative hassles and to comply with current rules and regulations, firms accept certain level of green practices in business operations including reduced CO2 emission, design eco-friendly products, and try to avoid environmentally hazardous substances during the procurement and production process.

Nonetheless, Laosirihongthong *et al.* (2013), and Testa and Iraldo (2010) have argued that the pressures can be from inside the organization, for instance, strategic motivation. In contrast, normative drivers are the social reaction toward the green value chain, whereas the companies who follow market leaders to survive in the market face mimetic pressures. In contrast, internal drivers are the company's commitment from the top executives (Laosirihongthong *et al.*, 2013; Zhu & Sarkis, 2004) in line with organizational values (Testa & Iraldo, 2010), support from mid-level managers as well as senior employees (Zhu & Sarkis, 2007) and long term vision for expected business gains. Tachizawa *et al.* (2015) classified the green value chain practices as monitoring and collaboration based and revealed that non-coercive drivers positively impact green value chain approaches. Coercive drivers suggested different implications as positively effects on monitoring-based green value chain practices but negatively impact collaboration-based green value chain practices (Securing & Müller, 2008). In order to achieve competitive advantage, green value chain practices are becoming unavoidable reality for SMEs (Huang *et*

al., 2012). However, it is argued that SMEs are having difficulties in practicing a green value chain as SMEs are short of knowledge, technologies, expertise, financial and human resources (Huang *et al.,* 2012; Lee *et al.,* 2012).

Vaaland and Heide (2007) stated that despite having substantial benefits of supply chain management, SMEs are not fully capable of harnessing the advantage of supply chain management and face difficulties when implementing SCM initiatives, especially those for the green supply chain. SMEs in the UK are diverse and heterogeneous (Hillary, 2004), which may be an obstacle to practicing a green value chain. Green value chain in a structured way. However, to achieve a competitive edge, gain consumer attention, and keep sustainable growth, SMEs need to be brought on board and seek new opportunities and innovation in the green value chain. Green value chain practices can provide good innovative opportunities for SMEs to enhance production, reduce costs and minimize environmental damage (Zhu *et al.,* 2007). Some SMEs that follow ISO 14001 has started to develop initiatives such as green design, green production, green distribution, and reverse logistics as green value chain practices (Chen *et al.,* 2010), and few studies on SMEs' green value chain practices. Laosirihongthong, Adebanjo and Tan (2013) proposed proactive and reactive environmental implementations in SMEs that do not have adequate proactive environmental strategies, green awareness, and environmental controlling systems. Zhu *et al.* (2007) proposed a set of implications in the study of the green value chain, including internal environmental management, green purchasing, investment recovery, cooperation with customers, and eco-design. Following are the Aspects of the green value chain management practices considered in this study as mentioned below:

Internal Environmental Management (IEM) is the practice of developing a green value chain as a strategic imperative through the commitment and support of senior mid-level managers damage (Zhu *et al.,* 2007). Many researchers Bowen *et al.* (2001); Lee *et al.* (2012) and Tseng *et al.* (2014) support this view, saying that it is essential to have support from top management to make commitment and encouragement to achieve corporate environmental objectives. In SMEs, the owner or manager is directly involved in the operations. Commitment and support are crucial. Green Purchasing (GP): GP has drawn significant attention among enterprises. It is relevant to procure products from firms to implement green value chain practices. Supplier selection is crucial and a key strategic route for firms to reduce the environmental impact on operations (Tseng & Chiu, 2013). Tseng *et al.* (2014) highlighted those green activities for the firm need to include strategic green purchasing. A recent study by Banaeian *et al.* (2015)

formulated an integrated framework consisting green supplier selection criteria for food SCs. These criteria can guide decision-makers in the selection of suppliers.

For example, firms with an ISO14001 certification can select as suppliers for larger food retailers such as TESCO, Sainsbury's, or Morrison. Investment Recovery (IR): Zhu *et al.* (2007) described investment recovery as the sale of excess inventories, scrap and used materials, and excess capital equipment. Investment recovery considers the utilization of idle resources for better purposes (Jabbour *et al.,* 2015), a closed loop of regeneration and recycling of by-products. In this way, an organization can recover or remanufacture products economically while reducing their negative environmental impact. Cooperation with Customers (CC): Tseng *et al.* (2015) argued that firms are unlikely to perform well if green value chain management practices are in isolation. To mitigate the ever-increasing environmental concerns of various stakeholders, a firm should pay attention to external stakeholders with internal business operations (Laari *et al.,* 2016). Downstream buyers or customers are essential to help reduce the environmental impact, and cooperation with customers significantly determines profit. Because food retail SMEs link with customers, SMEs can encourage customers to recover and recycle to reduce waste. Cooperating with customers helps customers understand a company's intention of green value chain practices, and the company can also better understand customer expectations and requirements (Ali *et al.,* 2017).

In addition, this can help improve customer satisfaction due to having close contact with customers, and local SMEs have many opportunities to understand, encourage, and collaborate with customers for environmental practices. Chinese SMEs have implemented the green value chain practices proposed by (Zhu *et al.,* 2007).; Huang *et al.,* 2012; Huang *et al.*,2015). These practices have won some recognition and were adopted by some researchers. This study investigated the drivers and pressures of green value chain practices on UK food retail SMEs and the impact of green value chain practices on their performance. The relationship between practicing a green value chain and organizational performance as a controversial area. Some scholars (Bowen *et al.,* 2001; Eltayeb *et al.,* 2011; Green *et al.,* 2012; Zailani *et al.,* 2012; Zhu *et al.,* 2005) found that green value chain practices improve environmental, operational, economic, and overall organizational performance, but Wang *et al.* (2013) claimed that there is an indirect relationship. Rao and Holt (2005) stated that green value chain practices enhance efficiency and bring synergy among strategic business units, which minimizes waste, saves

costs, and improves environmental efficiency. In the view of Tseng *et al.,* (2015), the association between green value chain practices and business performance has been researched, and argued that firms do not perform well if the capabilities apply in isolation. To balance triple bottom line performance, organizations are aggressively integrating green practices within business operations (Wu *et al.,* 2015).

Organizational performance measures by different academics using different components. Zhu *et al.* (2005) investigated green value chain pressures, practices, and performance in Chinese firms. De Giovanni and Esposito Vinzi (2012) examined environmental management and performance. Green *et al.* (2012) explored green value chain practices and firm performance proving a positive association using components such as environmental, operational, and economic performance. Wittstruck and Teuteberg (2012) measured three dimensions of performance, such as ecological, economic, and social. Testa and Iraldo (2010) had an additional factor on performance - the brand image has used by Eltayeb *et al.* (2011) as an intangible outcome; Zailani *et al.* (2012) measured the social performance of an organization using product image, company image, and stakeholder's perceptions. Practicing environmentally friendly procedures help improve the brand image (Setyadi, 2019; Zhu & Sarkis, 2004). Zailani *et al.* (2012) mentioned that SMEs' brand image is not that significant. Many large businesses often find the green value chain profitable because reducing waste by increasing buffer inventory, illuminating obsolescence costs, warehousing costs, energy reduction, and minimizing defects direct impact profitability. Following the 5 R's (recycling, reusing, redesigning, refurbishing, and reverse logistics) indirectly influences profitability by reducing production costs.

Besides, practicing a green value chain improves the corporate image, which brings positive consumer behavior to the corporations resulting in turnover and profitability (Lee *et al.,* 2012; Zhu *et al.,* 2007). Practicing a green value chain can positively influence efficiency in the working process, lead time, and service quality of the organization. Green value chain practices send positive messages to the stakeholders about the company and its activities. This method helps the firm in customer satisfaction and the media's attention, which changes consumer perception and buying behavior. However, as a firm's green value chain becomes global, its challenge increases for the firm to maintain manufacturing and distributing units, distance, and cultural diversity, which increase risks such as inventory control, product quality, lead time,

and mutual trust. For this reason, many organizations have tried to solve this type of SCM-related strategic problem through inter-firm dependence.

That is why Resource Dependence Theory (RDT) is a related theory to underpin the research on the relationship between green value chain practices and performances. RDT can describe the surroundings of an organization and its domain, implying that individual firms can barely achieve sustainable growth. Therefore, organizations rely on a mutual relationship among the partners through SC collaboration. Sarkis, (2011) also highlighted that the success of implementing a green value chain depends on the interdependency of partners in the SC and the collaborative approach and nature of their relationship. Based on RDT, firms that do not have the necessary resources can build a relationship with other partners in the SC and obtain resources through SC collaboration. Tseng *et al.* (2019) supported this by saying that firms that can select from a wide variety of suppliers and leverage resources throughout the firm can eliminate the environmental impacts using the GVCM practices (Tseng *et al.*, 2014). By doing so, all partners involved can reduce the negative effect on the environment, increase business performance and build a stronger customer-supplier relationship (Cao *et al.*, 2010; Carter & Rogers, 2008). Thus, it is clear that GSM is fully reflected as the green value chain related functions in different sectors in global business contexts, for instance, modern trade channels, SMEs, manufacturing firms, and services.

Thus, it has empirically supported to postulate that measures of the green value chain are almost in line with the application content of the green value chain. This study also considers the green value chain as the core of the green value chain. Many researchers conducted empirical studies to justify the green value creation of building material manufacturing firms in Sri Lanka. These studies mainly connect with green supply chain integrations and the synergy of operations for outsourcing activities (Central Environment Authority of Sri Lanka,2017; LafargeHolcim, 2017; Munasinghe & Dissanayake, 2017).

2.7 Critical analysis of theoretical models supplemented to the literature review

2.7.1 Porters value chain

Competitive advantage for an organization means not just matching or exceeding what competitors can do but ascertaining what customers want or expect from an organization and even sometimes exceeding their expectations (Dambudzo, 2013). Due to globalization, inter-

regional and international trade has lessened, and easy access to products. Consumers can trace and get the best product to their requirements at an affordable price. The rise in customers' expectations and increasing competition among competitors make a company restless and try to achieve core competence (Bryson, 2018). A Value Chain analysis is a Strategic management tool used to measure the significance of the customer's perceived value. By making the organizations determine the strategic advantages and disadvantages of their accomplishments and value-creating processes in the marketplace, VCA (Value Chain Analysis) becomes an essential element for assessing an organization's competitive advantage. The value chain analysis considers managers, management accountants, and top-level management who are part of the decision-making to implement value chain analysis in their respective organizations (Antoniou *et al.,* 2011).

The concepts, tools, and techniques presented here apply to all organizations that manufacture and sell goods and services. Today, Organizations face intense competition in the global marketplace. To sustain and improve competitive advantage, organizations must determine to what extent they can meet the dynamic expectations of the consumers. Value chain analysis examines the creation of value across the entire range of activities and processes that shape the final offering to customers and provides a significant vision for the organization's long-term growth and existence (Chen & Zhang, 2009). The present study defines concepts and techniques of value chain analysis; describes the primary requisites and elements of the value chain approach: internal cost leadership analysis, internal differentiation analysis, and vertical linkage analysis; plans three useful strategic outlines, industry structure, core competencies, and segmentation; and discusses the trends, issues, and challenges that are involved in value chain analysis. The concepts and techniques presented can be practical and applied in all organizations. The value chain activities include research and development, design, production, marketing, distribution, and after-sale service. These support activities are a set of supplementary activities that include accounting, finance, human resources, and information technology (Schmitz, 2005), and all the task in the value chain added - value from the customer's perspective (Horngren *et al.,* 2012). Value chain analysis is a strategic tool that aids in creating an organization's structural strategy (Robins *et al.,* 2009). It primarily focuses on activities that generate value for customers, while activities that are not valuable for customers will be enhanced and improved service delivery (Thompson *et al.,* 2005).

The value chain analysis specifies the entire set of actions required to bring a product or service from conception to completion, including the various stages of production, final delivery to the end consumer, and disposal after usage (Porter, 2008). The way an organization organizes and performs distinct operations gives it a competitive advantage. There are two types of activities while competing in a specific industry, such as primary and secondary. Primary operations involve ongoing product and service production, marketing, delivery, and servicing, while secondary activities include procurement, technology, human resource activities, and other infrastructure tasks that support alternative activities (Porter, 2012). When an organization acquires resources and technology can make changes in products and services to satisfy customer needs and wants or can react and adapt quickly to the changes in the competitive environment (Dahlstrom & Ekins, 2006).

Michael Porter proposed the concept of a value chain in 1985 to depict how customer value accumulates along a sequence of operations that leads to an end product or service. Porter defines the value chain as "the internal procedures or actions that a firm undertakes to invent, produce, promote, deliver, and maintain its product." An organizational value chain and the method in which it executes certain operations reflect its history, strategy, approach to implementing its plan, and the underlying economics of the activities. Figure 1 depicts Porter's classification of company operations into two basic categories: primary activities and support activities (Porter, 2012). Primary activities entail the production, delivery, and after-sales support. These activities are often the organization's line activities. The support activities are inbound logistics (material handling and warehousing); operations (converting inputs into finished goods); outbound logistics (order processing and distribution); Marketing and sales (communication, pricing, and channel management); and Services (installation, repairs, and parts) (Dahlstrom & Ekins, 2006). Procurement: Purchasing of raw materials, supplies, and other consumable items as well as resources; Technology development: Know-how, procedures, and technological inputs required in every value chain activity; Human resource management: Selection, promotion, and placement; Appraisal; Rewards; Management development; and Labour/employee relations; and Firm infrastructure: General management, planning, and finance (Burnes, 2002).

Govindarajam and Shank (1993) described the value chain in broader terms than Porter. According to them, "the value chain for any organization is the value-creating activities that

extend from basic raw material sources from component suppliers to the ultimate end-use product delivered into the hands of the final consumers. “This description views the firm as part of an overall chain of value-creating processes (Hutaibat, 2011). The industry value chain starts with the value-creating methods of suppliers, who provide the basic raw materials and components. It then moves on to the value-creation strategies of various customers or end users, culminating in material disposal and recycling. The industry value chain and the value chain activities within the firm will be compared (Dekker, 2003). Customers (high-quality products) and green value chain partners will benefit from the green value chain (higher earnings) (Ruan, 2020).

Traditional strategies to reduce the CO2emissions in the cement industries by applying lower clinker/cement ratio by increasing additives and producing blended types of cement (Koc & Bozdag, 2017). The organizations use technological changes to shift toward a more energy-efficient process (e.g., from a wet process of cement making to a dry process), removal of CO2 from flue gases use of alternative fuels and raw materials. The World Business Council for Sustainable Development (WBCSD) and the Cement Sustainability Program (CSI) both support this initiative (WBCSD). An effective green value chain management will increase profitability or reduce costs (Feller *et al.,* 2006; Speller *et al.,* 2007). Green value chain management is the end of the loop through an integrated Green Value Chain from supplier to manufacturer to client (Zhu *et al.,* 2005). A green value chain creates when green manufacturing, green distribution, green marketing, and green reverse logistics are joined (Chien & Shih, 2007). Al-Midimigh *et al.* (2004) claim that value chain management focuses on the customer from beginning to end, making the green value chain only a minimal portion of the overall value chain. Feller *et al.* (2006) summarized the relationship between a value chain and a green value chain as complementary views of an extended enterprise with integrated business processes, which enable the flow of products and services in one direction, while value as represented in terms of demand and cash flow in other direction.

These various definitions denoted by different authors summarize in models for ease of reference. Based on the preceding discussion and by integrating the salient concepts of all authors, the value chain can be redefined as an upstream flow of value, in the form of demand or specifications, from customers to supplier via both the horizontal and vertical linked-set (Liu *et al.,*2016; Sampson & Spring, 2012). The green value chain is a downstream flow of value

created as a product or service, from the source to the customers, via the horizontal and vertical linked-set. The green value chain generates by considering the mitigation plan to allay the environmental aspect and impact (Sampson & Spring, 2012; Wang *et al.,* 2015).

Companies are dealing with increasing pressure from several stakeholders regarding the environmental performance of their products and processes. The customers are demanding green products, employees and nearby residents are worried about health and safety implications for production, and non-governmental organizations are pressing companies to comply with legal and other requirements (Pesonen, 2001). Future sustainable competitiveness is therefore closely dependent on to what extent the manufacturing companies are environmentally friendly. The value chain was intended as a method of mapping and identifying how the critical activities of an organization came together harmoniously to generate sustainable value creation for all stakeholders (Feller *et al.*, 2006). The value chain was a process mapping that enables the organization to constantly view each of the individual activities under the sub-sections and make it more efficient and cost-effective to enhance the profit margins (Taylor, 2005).

Rabelo *et al.* (2003) define green value chains as life cycle processes to support the physical, information, financial, and knowledge aspects of moving products and services from suppliers to customers. Hult *et al.* (2008), A green value chain as a system of people, activities, information, and resources involved in creating a product and then moving it to the customer. The primary focus on the green value chain upstream-pivoted is mainly on integrating supplier and producer processes, reducing waste and costs, improving efficiencies of green value, and the flow of materials from their various sources to their final destinations. The goal of managing the green value chain creates value for both customers; in the form of high-quality products, and the green value chain partners; in the form of increased profits, efficient green value chain management will lead to bottom-line improvement or cost reduction (Feller *et al.* 2006; Speller *et al.,* 2007). Porter (2012) defined "value chain as the combination of nine generic value-added activities that work together and are practiced within a company to provide value to customers. The value within the context of Michael Porter's Competitive Advantage framework perceives as the amount buyers are willing to pay in return for what a company provides. According to Houlihan (1985), the value is managed through what has been referred to as the green value chain (Chien & Shih, 2007). Al-Mudimigh *et al.* (2004), and Feller *et al.*

(2006) later extended the definition of value to a broader extent. Speller *et al.* (2007) define a green value chain as life cycle processes to support the physical, information, financial, and knowledge aspects of moving products and services from suppliers to customers. Hult *et al.* (2008) define a green value chain as a system of people, activities, information, and resources involved in creating a product and then moving it to the customer.

However, in today's context of business, the social responsibility and the impact of transparency through social media have caused huge concern for organizations that can no longer look to merely be profitable by improving the efficiency of the activities within their value chain (Chien & Shih, 2007; Weber, 2008). Porter's value chain has a limitation because it was built based on operational and green value chain activities. It is unable to fully take into account the demands of the social environment, which also affect an organization's capacity to sustain its profit margin (Chien & Shih, 2007; McCormick & Kåberger, 2007). McCormick and Kåberger (2007) referred to this aspect when they indicated that organizations need to work beyond developing a competitive advantage by efficiently conducting their internal activities by considering the impact these activities have on society. According to Johnson (2017), organizations must develop successful business operations built around the social, environmental, and financial aspects. This alludes to the drawbacks of many activity-based analytic tools, into which the value chain is collective. This part then runs counter to Porter's value chain the business operation must be efficient to enhance profit (Maloni & Brown, 2006).

It was suggested that the value chain be integrated with the customer segment analysis to integrate internal and external perspectives. While this was proposed to support the idea that a feature or product only gives the organization a competitive advantage if the priority customers are willing to purchase it (Li *et al.*, 2004). It raises a new point of concern in today's customers are just as concerned with ensuring value for money as they are with how a product develops and its environmental impact (Lin & Ho, 2011). By this definition, the cost of operations can generally increase, but the organization remains tenable as they meet stakeholder expectations (Weber, 2008).

The cement industry has specific activities that critical to its operation and ability to provide value to its customers. These activities also cause environmental pollution both directly and indirectly (CEMBUREAU, 2014). The percentage of clinker in the mixture correlates with the

number of carbon emissions as clinker obtains by heating limestone, which is the base raw material. A lower proportion of clinker would mean a lower ratio of lime stones converts in the kiln to clinker (CEMBUREAU, 2014). Value chain operational aspects include some primary components concerning the cement industry, whereas many organizations try to add green McCormick (2007) practices within those aspects to reach sustainable results. The transportation of limestone that has been quarried to the cement mill is a large part of the operations process, which is a vital aspect of the value chain (Chien & Shih, 2007).

The limestone and other materials such as gypsum are transported in large trucks that emit large quantities of carbon dioxide emissions 5 times more than a passenger vehicle (CEMBUREAU 2014). Packaging is another activity and the company's use of large volumes of paper as a packaging material contributes to a negative environmental impact. Bags are not recyclable, but they are biodegradable (LafargeHolcim, 2015). The restriction on selling price is a constraint on the financial operations of the business operational activities to be conducted within an extremely tight budget to maintain a worthwhile profit margin to meet shareholder expectations (LafargeHolcim, 2015). Human resource practices include social responsibility in the culture, skill, structure, and knowledge that have evolved to behave in a specific manner and conduct the activities in the value chain (LafargeHolcim, 2015). The process of being concerned with the growing importance of managing environmental concerns that arise from primary stakeholders has become one of the most significant aspects for senior management and value chain managers (Maloni, & Brown, 2006).

Because of the intimate relationship between the value chain and the environmental footprint that the company produces, these professionals focus on re-evaluating the actions performed in the value chain (Weber, 2008). The value chain has evolved into a significant component that firms are using as a type of sustainable operations to get a competitive edge in different industries (Maloni, & Brown, 2006). According to Gandhi *et al.* (2006), firms prioritize environmental management systems because they enable them to obtain the following operational benefits. Organizational responsibility has resulted in a considerable shift in the value chain, which can be followed through its stages of evolution, and has finally settled on the green value chain (LafargeHolcim, 2015). Gandhi *et al.* (2006) claim that the adaptation of the green value chain will result in sustainability because it will forge a Win-Win Alliance with stakeholders and enable enterprises to establish a favorable reputation as socially responsible

businesses. While reaching optimal operations and decreasing material flows will help firms minimize waste in all areas and boost profitability, greening the value chain will also increase the organization's efficiency and sustainable competitive advantage. (Weber, 2008).

The theoretical and practical models as remedial to the existing situation of environmental damage need to be designed within the supply chain activities to address the green value creations (LafargeHolcim, 2015; Zhu *and* Sarkis, 2007). The researcher must design using a quantitative and a deductive survey based on the targeted experts in the industry. The literature shows that integrating environmental practice in organizational activities has become an irreversible reality. Greening the SCs is the innovation to achieve competitive advantage. There are specific drivers and pressures in the literature broadly categorized as pro-active and reactive drivers by Laosirihongthong *et al.* (2013); coercive and no coercive drivers by Tachizawa *et al.* (2015); internal and external drivers by Lee (2008); Testa & Iraldo (2010); Lee *et al.* (2012); Zailani *et al.* (2012) and so on. Firms get stimulation from the various sources of drivers and pressures to practice a green value chain in their operations. Due to external pressures (regulations, competition, and customer expectation) and internal driving forces such as commitments from top management based on organizational values, support from mid-level managers and senior employees, and expected business gains, companies are institutionalizing environmental practices in business operations. Many organizations practice green value chains as internal environmental management, green purchasing, Eco designing, investment recovery, and customer collaboration (Zhu & Sarkis, 2007).

There are inconclusive arguments in the literature about whether green value chain practices improve performances or not, which have evidence from both positive and negative performance outcomes (Green *et al.*, 2012; Laari *et al.*, 2016; Rao and Holt, 2005; Zhu & Sarkis, 2004). There were dissimilar components in measuring firm performance in the previous studies. Tseng *et al.* (2015) claimed that green value chain practices and firm performance have been comprehensively studied, but firms are unlikely to perform well without depending on the resources of partners in their green value chain (Chien & Shih, 2007). s. For SMEs due to the scarcity of resources including technological know-how, knowledge, expertise, and human and financial resources (Huang *et al.*, 2015; Lee *et al.*, 2012), they are dependent on the partners in their green value chain (Chien & Shih, 2007) become critical. To minimize risks and complexities in their Green Value Chain (Chien & Shih, 2007). Inter-firm

dependence to improve firm performance becomes inevitable. That's why resource dependence theory was used in this study to understand performance implications. In this study, performance was measured considering operational efficiency, brand image, and profitability.

2.7.2 Kano model

A critique of the Kano model emphasizes the "M-H attribute of quality". The hypothesis was created by modifying Herzberg's Motivation-Hygiene.'s Theory". A two-way quality model based on consumer perceptions and experiences (Kano *et al.,* 1984; Kano & Takahashi 1979; Mikulić, & Prebežac, 2011). The different researchers used the Kano model in a variety of projects. Tontini (2000) suggests alterations to the Kano model by using it to enhance customer service at an Italian restaurant. Matzler & Hinterhuber (1998) used the Kano model for product development and integrated it into implementing quality functions. Schvaneveldt *et al.* (1991) applied the Kano model at supermarkets, restaurants, laundromats, and banks. The Kano model's vertical axis symbolizes consumer satisfaction and dissatisfaction. The horizontal axis denotes whether or not conditions are adequate (Pandey *et al.,* 2022). Taking advantage of the relative relationship, the ease with which the quality components can be used, and the sense of customer satisfaction. Five categories of quality can be distinguished: desirable quality, must-have quality, indifferent quality, one-dimensional quality, and reverse quality (Chen & Chuang, 2008).

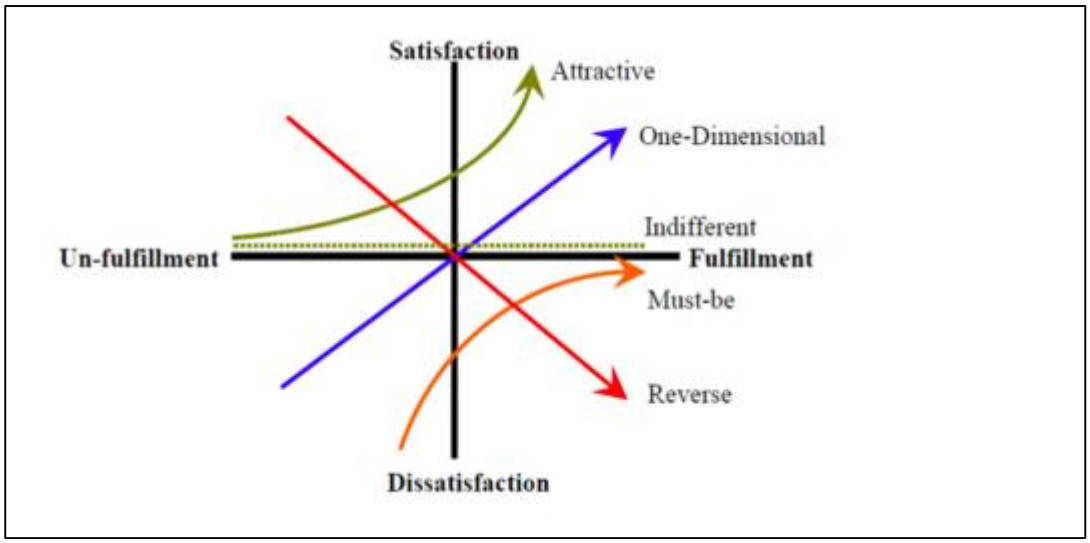

Figure 2.5: Kano Model of Customer Satisfaction (Source: Chen & Chuang, 2008)

According to Mikulić and Prebezac (2016), the Kano model has increased its presence within the tourism industry in recent years when integrated with the importance-performance analysis (IPA). Rashid (2010) explains that using the Kano model alone is not essential to the company. They argue that when combining these two models, the reliability of its managerial implications increases. Many studies argued for service quality improvement using the Kano model and IPA in restaurants, tourism, and hospitality (Gregory & Parsa, 2013; Khan *et al.,* 2017; Tontini, 2000; Tontini *et al.,* 2013 ;). According to a study conducted by Tontini *et al.* (2013) on the service of pizzeria restaurants, they stress the relationship between attributes performance and customer satisfaction as a focal point to gain market success. Mikulić and Prebezac (2016) highlight the 'methodological development' achieved from the integration of the Kano model with IPA will increase the overall reliability of its managerial implications. Chen and Ko (2015) explain that the Kano model has been used to study "tangible" travel-related services. IPA is an extended version of the Kano model and allows to study of "the perception of the visitors and their willingness to revisit" (Chen & Ko, 2015, p. 272). The aim of IPA, according to Mikulić (2007), is to directly draw the inference of improvement priorities from the dimensions positioned in the grid based on the current level of performance. Martilla and James (1977) developed the concept of IPA into two components; 1) the importance of the service and 2) the quality of the service. Chen and Ko (2015) argue further that IPA allows an opportunity to study the organizational competitive advantage in the market. IPA is a great tool to measure customer satisfaction in tourism (Mikulić, 2007). Chen and Ko (2015) explain that the IPA divides into a matrix with four quadrants. According to Chen and Ko (2015), the vertical axis represents attribute importance, while the horizontal Anderson (2003) argues one of the vital tools to enhance organizational growth. Hofstede (1987) explains companies can understand the behavior of a local market through large customer segments.

Moreover, Füller *et al.* (2006) argue that applying the Kano model to gain an understanding of tourists' attitudes about the factors of environmental influences can result in more intense outcomes. Doole and Lowe (2012) described that a company should consider the ecological impacts when entering new markets; social and cultural, legal, economic, political, and technical. When entering a new country market, it is significant to keep the psychic distance in mind, which implies the range of the cultural differences between local-domestic and host-domestic countries (Coviello *et al.*, 2017; Lee & Karlson, 2017). Johnson and Vahlne (2009) argue further that it is by reducing the psychic distance that a firm can reduce the uncertainties

that market entry entails. Madsen and Servais (1997) explained that the mobility of the population increase across nations with a much higher number of potential employees with competence to communicate with, understand, and operate in foreign cultures. Since the introduction of the paper "Attractive Quality and Must-Be Quality" in 1984 by the Japanese Professor Noriaki Kano, the theory of attractive quality and the use of the Kano model have received growing interest. At the end of the 20th century, when business activities got more global and competitive, the importance of understanding the customers rose. To do that, companies started to use the methodology of Kano. This method helps to understand the implications of different quality attributes on customer satisfaction. The increasing implementation of the theory in practice led to further activity in research, especially as some managers have experienced problems with new methods (Witell *et al.*, 2013).

As a consequence of extensive research in the field of attractive quality and the Kano methodology, papers that review the literature was published. In 1993, a collection of 11 papers that elaborated experiences and theoretical ideas of attractive quality was published in The Center of Quality Management (Sauerwein *et al.*, 1996). Witell *et al.* (2013) provided systematic literature research about the first two decades in the Quality Management Journal in 2008 and a further overview of how the literature developed over time in 2013. Witell and Löfgren (2013, and Högström *et al.* (2016) attempted to stimulate more research about the very core of the theory of attractive quality. Kano and Takahashi (1979) introduced the concept of motivator-hygiene (MH) based on Herzberg´s theory. The Kano model supports job satisfaction is different from the ones, which cause job dissatisfaction (Oh *et al.*, 2012). Five years later, Kano *et al.* (1984) introduced their theory of "attractive quality and must-be quality" in the Western world. A new field of research was born through the conceptual basis and the elaboration of the Kano methodology. Gustavsson *et al.* (2016), and Lilinares and Pag (2011) published some conference papers, which reinforced the diffusion of the theory of attractive quality. One of the significant contribution within the first 15 years was a compendium of ideas and experiences of using the concept in practice by Berger *et al.* (1993).

The ideas and conceptualizations of the paper in The Center for Quality Management Journal are still vital to understand the Kano methodology. Based on this paper, Lee and Newcomb (1997) executed a case study from NASA, in which new measures to simplify the classification of quality attributes. Furthermore, the authors discussed and identified alternative statistical

tests and guidelines for their use in practice (Lee & Newcomb, 1997). Another researcher in the Genesis phase that strengthened the foundation for the theory of attractive quality through an extensive empirical investigation in the ski industry (over 1500 customers) was Matzler (Matzler *et al.* 1996; Matzler & Hinterhuber 1998). The first 15 years after Kano's theory of attractive quality opened in the field of research. There are different new ways exist to measure the given construct of quality attributes to improve its practical use. A reason for the huge increase in the number of papers is that the papers were published in an expanded spectrum of journals, and the field of application for the case studies extended e.g. from products to services. It is from a conference in Sweden, and the title of the paper is "Life cycle and creation of attractive quality" (Noriyaki, 2001). In this paper, Noriyaki (2001) examines available clickers in 1983, 1989, and 1998. His conclusion of this investigation is, that remote control was an attractive quality attribute in 1983, a one-dimensional attribute in 1989, and a must-be quality attribute in 1998 (Noriyaki, 2001).

A few years later Nilsson-Witell and Fundin (2005) released a research paper, which examines the early stage of the life cycle of the attractive quality 2005. The findings in their paper are that new attributes are first aphetically before they become effective. The results of these two papers confirm with empirical evidence the life cycle of successful quality by Kano *et al.* (1984). But there is a shortcoming in empirical research on other life cycles for quality attributes e.g, some attributes, which failed in the market. Within this phase, the focus of the research was on three topics. These topics are (1) the categorization of quality attributes (2) other ways to classify quality attributes, and (3) the connection between the Kano methodology and other methods. The first topic in the Discovery phase was the classification of quality attributes. After revising several research papers, 17 used the five-level Kano questionnaire, in which every question has five answer alternatives. But only six have employed how to create a questionnaire. To improve the outcome of the empirical investigation, some authors proposed to modify the questionnaire, the evaluation table, or the sort of analysis.

One example of some changes is the wording of the answer possibilities because they were obsolete in nearly all the papers. To provide evidence for this statement, Nilsson-Witell and Fundin (2005) compared the answer possibilities of an American (Berger *et al.*, 1993) questionnaire with a Japanese (Kano *et. al.*, 1984) questionnaire. With this comparison, Nilsson-Witell and Fundin (2005) proved, that the portion of ambiguous classifications

dropped. This means, that the validity of a study can be enhanced by selecting answer possibilities with the correct wording. Considering the second topic within this phase, other ways to classify quality attributes, ten out of 27 empirical studies deal with this topic. Some examples are Jacobs (1999), who analyzed the satisfaction of customers with TV service, and Anne and Grönholdt (2001), who evaluated staff satisfaction. Both of them classified the attributes based on their importance with the help of a dual-importance grid. In addition, there is Noriaki (2001) released a three-level questionnaire. Furthermore, Emery and Tian (2002), and Von Dran and Zhang (2002) employed an approach with direct questions. Kano *et. al.* (1984) invented the traditional approach to classifying attributes, and Witell and Löfgren (2007) compared this approach with some substitute approaches (Anne & Grönholdt, 2001; Emery & Tian, 2002) in an empirical study. However, the study shows that none of the other approaches led to an outcome that has any parallels with the traditional Kano methodology. Moreover, the results from the three-level questionnaire consistently differ from the results of the five-level Kano questionnaire (Witell & Löfgren, 2007). With this knowledge, Witellm, *et al.,* (2013) conclude their literature review, that more exploration of other approaches is required. For this reason, they advise using the traditional five-level Kano questionnaire. The third research topic is based on Matzler and Hinterhuber's (1998) paper and is about the connection between the Kano methodology and other methods, like QFD, SERVQUAL, and FMEA.

The most commonly used is a combination of the Kano methodology and QFD. Examples, therefore, are Shen *et al.* (2000), and Tan *et al.* (1999). They modified the weights of the importance of the customer needs in the House of Quality in QFD with the categorization of attributes. Pawita and Tan's (2003), and Tan and Pawitra's (2001) and approaches prioritize attractive quality attributes and in contrast to that, Shen *et al.* (2000), Tan and Shen (2000), and Tan *et al.* (1999) prioritize must be quality attributes. The research, which has been pursued in this phase, analyzed other approaches and explored new fields for the employment of the Kano methodology. The substitute wordings, approaches, and types of analyses turned out to be beneficial because they offer variety in the classification of quality attributes. But the difference between the alternatives to the traditional Kano methodology is the outcome because it often differs from each other. So, the problem is, that the most effective method still has not been identified. From 2009 on the rate of published academic papers about the theory of attractive quality of academic papers including the Kano methodology was increasing heavily. Compared

to the time between 2000 and 2008, the number of papers published each year quadrupled. In 2009, the number of papers reached 26 in total. One reason for the increased outcome of papers was the establishment of new channels for publishing. The African Journal of Business Management, which was established in 2007, contributed seven publications within two years. New fields of research range from quality, management, and service journals that got expanded by domains like Building and Environment and Quality of Life Research Journal. The number of papers was increasing, and the types and the content of the preceding phases remained the same. Hence, services were still the dominant empirical context and the combination of methods like QFD and SERVQUAL with the Kano methodology remained the most common research approach. Although the number of other domains increased, the number of research that was questioning and challenged the theoretical and methodological foundations of the theory was scarce.

A high number of papers instead are using Kano´s model and modifying it. Examples of that are the fuzzy approach for a more objective questionnaire (Lee & Huang, 2009) and the modified cross axis of Kano´s model from Shyu *et al.* (2013) Nevertheless, there were some exceptions: a special issue of The TQM Journal for instance, which was published in 2011, had the intention to discuss and contribute the further development of the theory of attractive quality. The traditional wording of questions, answering alternatives and the evaluation table got challenged by Högström in 2011. A further exception was Gruber *et al.* (2011). The paper investigated the attributes of effective frontline employees who are involved in personal interactions. The study revisited the life cycle of quality attributes, which was introduced by Noriyaki (2001), concluding that the attributes of service employees differ from country to country in a systematic pattern. Another paper on the Maturity phase that included the dynamics of quality attributes in terms of the existence of the life cycle of quality attributes was by Löfgren *et al.* (2011). Their research proved the existence of three life cycles of quality attributes, which supports the significance of the theory of attractive quality. Furthermore, their research paper examined the possibility for companies to create reverse movements for certain quality attributes. Conclusively it can be said that in the phase between 2009 and 2016 the number of papers increased, the content, however, remained largely the same. The amount of paper which are questioning and pushing the research on the theory of attractive quality is scarce. Instead, researchers published papers that entail new application fields for empirical studies and modified versions of the Kano model. The theory of attractive quality and the Kano

model can be described with a steady increase in interest. Furthermore, according to Tontini *et. al.* (2013), a key challenge to success is, to identify the relation between attributes performance and customer satisfaction (Tontini *et. al.*, 2013).

Therefore, more research in this field should be conducted. While the yearly output of papers was only one or two, in the beginning, the output of papers in the last years was always above 20 per year. This development of research, however, is connected with the trend that many researchers are simply applying the Kano methodology to new business contexts. Many contributions are missing the discussion about the consequences of the theory of attractive quality. Löfgren *et al.* (2013) pointed out in their paper that new research agenda for the future is needed. The researchers should investigate areas like the life cycles of quality attributes or customer satisfaction on the level of the whole product or service. In the last three years, however, the research agenda did not change, that is led to a stagnant level of new research on the core theory of attractive quality. The authors of this paper identified a linkage of the theory of attractive quality and the Kano methodology with a school of thought that is "The Kiel School".

The following paragraph will explain this linkage in detail. "The Kiel School" belongs to the Kiel Institute of World Economics. It was founded in 1914 by Bernhard Harms, and the leader from 1926 to 1931 was Adolph Lowe. After Hitler stepped to power "The Kiel School" was demolished, and the members of the school spread over the whole world, but some of the members built up the New School for Social Research in New York (HET website, 2017). Moreover, the research field of "The Kiel School" can be described as "structural theories of growth and the business cycle" (HET website, 2017).

It claims that the origin of the growth and cycles is a relation between different divisions in the real economy (HET website, 2017). The identified linkage is more specific between the life cycle of quality attributes and the business cycle. A cycle is "something that comes and goes and returns with some regularity, rather than a singular incident" (HET website - Cycle, 2017). So, the quality life cycle can be compared with a business cycle. According to Noriyaki (2001), quality attributes change for the competition and fast technological development that release the innovations. In the approach of Kiel School, "technical progress continuously modifies the real rate of return on capital, thereby causing sectoral maladjustments, permanent excess

capacity, and technological unemployment during the process of growth" (HET webiste, 2017). This means technical innovations are changing the business cycle and as well quality attributes. There is no agreement among the academic community, particularly not in the corporate sphere, concerning the definition and understanding of terms such as corporate strategy, business strategy, and business model. The authors of this paper consider the beginnings of the emergence of the business strategy to lie in the period after World War II, when Borden (1964), and Culliton (1948) later came up with the idea of stipulating a product strategy and product portfolio using a marketing mix.

Kotler (2010) was primarily responsible for popularizing this issue. These researchers laid the foundations for defining an organizational business strategy. Various typological business strategies came to be used in the literature on strategic management, with Porter's market-oriented approaches becoming the most widely cited. The publications of Michael Porter (Porter, 2012; Porter, 2015) and other authors (Rezapour *et al.*, 2017; Yadav *et al.*, 2017) represented a significant turning point in the approach to the strategies and their generation. Porter defines a strategy as competitive in terms of a corporate strategy. Meskendahl (2010) and Wirtz *et al.* (2016) describe a business strategy that addresses how enterprises gain competitive advantage, how they decide to compete in the market, and what business model provides them with a competitive advantage. Yuan *et al.* (2021) emphasize developing a business strategy by focusing on understanding and adapting to the business and market environment to maximize business performance.

Yang *et al.* (2015) propose to use one of Porter's three generic competitive strategies. Porter (2015) has contributed to the way and frequency of projection and implementation of the business models, stating that a good analysis is crucial for creating a competitive strategy. It is unreliable to create one in advance, as it may take several years to find an appropriate approach. The study depicted that any business issue should understand as a product of how the enterprise creates value for a customer. The research priority of this topic consists of theoretical finalization and practical verification of a business model that uses the principle of generation of process added value for the customer to achieve a margin. This is based on a description of business processes, their decomposition in the corporate environment, and subsequent value analysis to identify their contributions to the overall margin (Jin *et al.*, 2021; Pandey *et al.*, 2022).

The authors suggest a creative method of business strategy formulation based on an examination of value streams in a firm about the integral and unique system of the corporate environment as a recent aspect that respects a system approach to the enterprise. The structure of this article respects the research goal (Shi & Peng, 2021; Yin *et al.*, 2021; Zogi *et al.*, 2022). Many studies depict a theoretical description of business models and associated mathematical and statistical methods using the output (dimensional reduction and logit regression). The organizations use optimized logit models during the results section to identify the effects of internal materials and the micro and macro environment, including the significance of these components in their integrated form. Finally, the researchers answered and discussed questions based on the research outputs. The authors also suggest directions for future research activities in this field (Andriani *et al.*, 2021; Chen *et al.,* 2021). Small and medium enterprises represent a crucial part of a national economic system. The quality of the business environment is critical for these organizations as it can create favorable conditions for their development (Dobes *et al.*, 2017).

Kozubikova and Kotaskova (2019) state that business risks strongly affect the quality of the business environment in which small and medium enterprises operate. The researchers conclude that the primary market risk is the most important. Lestari *et al.* (2020) stated that setting goals and sharing the sources and knowledge for the innovativeness of their projects and competitive advantage is crucial for small businesses. Belas and Gabcova (2014) have determined that small and medium enterprises are prone to higher business risks because they are sensitive to changes in the business environment. The study explain that SME productivity is affected by obstacles, even though their contribution to economic growth, employment, and competitiveness is high within the country in which they operate. In the Czech business environment, the terms business and corporate strategy and business model are often confused (Bures, 2019; Ingaldi &Ulewicz, 2019).

A business model, according to Apte and Davis (2019), is a detailed explanation of the principles guiding the production, delivery, and expression of values in a firm. Teece also highlights the significance of a business model and its linkages to a business strategy, innovation management, and economics (2010). A business model that creates value for the client and money for the company, according to Massa *et al.* (2017), reflects the company's sources that are gathered and structured in a process that creates the value. The authors

Casadesus-Masanell and Ricart examine the connection between the business model and the carried out company strategy (2010). According to a different group of authors, business models can be thought of as structured management tools that are essential to a company's profitability and competitiveness (Kharub & Sharma, 2017; Wirtz *et al.*, 2016). According to Porter, the value chain is an effective instrument for structuring a business into strategically significant operations, opening the door to the prospect of higher pricing and reduced expenses (Kharub & Sharma, 2017). The value chain notion was discussed by several authors. (Feller *et al.*, 2006; Kalmykova *et al.*, 2018; Kim & Chai, 2017; Missimer *et al.*, 2017). Understanding whether a business entity has the potential to create added value and whether it can take advantage of this in the future is an essential step in diagnosing its potential (Jayaraman & Luo, 2007; Kahreh *et al.*, 2011; McNeish & Kelley, 2019). The research described above has laid the foundation for a business model design. Academic works and examples from corporate practice have appeared in the organization of all categories of corporate strategies and models into a hierarchical and interconnected model. According to study findings by Marx (2015), the Product Strategy (differentiation versus low costs), the Best Value Strategy, and the Blue Ocean Strategy all significantly affect company management. For instance, Walmart has a well-designed business model that prioritizes "everyday cheap prices" for a variety of products that are available to consumers readily and in favorable locations (Inkpen, & Ramaswamy, 2017; Knoke, 2018; Kotabe & Kothari, 2016; Malhotra & Dash, 2011).

Modern businesses generate their business strategy and strategic models using the business and information paradigm, which emerged at the beginning of the 21st century. It differences in the collection, storage, access, and transmission of the information (Gatautis, 2017; Gatenby & Foo, 1990; Meskendahl, 2010; Wirtz *et al.*, 2016), as well as increasingly intensive processes of innovation and digitalization in the corporate environment. Demir *et al.* (2017) and Dagnino *et al.* (2017) discuss the increased pace of changes concerning innovations disrupting the established procedures in industrial branches. The researchers have noticed speed and intensity of the procedural changes may have an impact on strategy and business models.

Many authors have discussed the progressive digitalization of business strategies (Bharadwaj *et al.*, 2013; Wirtz *et al.*, 2016) and business models (Casadesus-Masanell & Ricart, 2010; Wirtz *et al.*, 2016). Many businesses have drastic changes, such as the internationalization of trade, globalization, and geographical changes from the viewpoint of global economic centers

(Wisniewski & Brzezicka, 2020). Digitization is the current innovation procedure that recreates a crucial role in transforming business models. It provides opportunities for adjusting higher quality and efficiency for the existing business processes and connecting new actions to deliver the maximum added value (Martins *et al.*, 2015; Mcdonald, 2016; Palandeng *et al.*, 2018; Vyas & Gupta, 2017). Summing up the current degree of scientific knowledge in business modeling, there is no consensus on the definition and the way of its projection of implementation in business practice (Gabriel, 2006; Hedge, 2015).

2.7.3 AHP

In critical review of the AHP model we see that many economic indicators, currently, are showing a declining tendency, such as a minus economic growth, weakening stock market performance, and poor supply chain due to the COVID-19 (Gates, 2020). The COVID-19 is a virus appearing in December 2019 and has been the largest threat in our society. Droplets can transmit this virus from the infected ones, then spread rapidly. Until now, no pharmaceutical treatment is known to be effective, so this virus has become the center of international attention (Ayenigbara, 2020; Cortegiani et al., 2020; Dong et al., 2020 ; Gao et al., 2020 ; Rothan & Byrareddy, 2020; Sun et al., 2020;). The government mandates a social distancing program and instructs the less important businesses to close to slow down the spread of the epidemic. However, this has an impact on various industries because the government limits activities and workers. (del Rio-Chanona et al., 2020).

This outbreak came suddenly and affected the global economy and caused spillover damage. It also creates demand and supply shocks in the manufacturing and non-manufacturing industries, such as the sports industry, restaurant business, entertainment, events, banking, oil and gas, IT and many more (Inoue & Todo, 2020 ; Ozili & Arun, 2020; Ramasamy *et al.*, 2020). As a consequence, the productivity of many company's decreases, and so does the sales turnover. Hence, companies should work harder to tackle this pandemic. We need to know that in dealing with problems, we will have to make the right decision to take a step forward in order to find the solutions. A decision making based on quantitative and numeric approaches will produce a better result (Hopkins, 2011). One of the methods which can be used to support a decision-making process is the Analytical Hierarchy Process (AHP). AHP method is chosen in this study because it utilizes a qualitative and quantitative analysis. Besides, it breaks down

the elements related to the decision making to be regulation, criteria, and scheme (Geng *et al.,* 2018 and Liu *et al.,* 2018).

AHP method is a ranking process used in decision making and widely used throughout the world, both in manufacturing and non-manufacturing industries, such as government agencies, educational institutions, health facilities, and others (Vardopoulos *et al.,* 2021). AHP is a model of Multi-Criteria Decision Making (MCDM), allowing a decision-making system to have appropriate techniques for ranking the managerial problems critically (Aziz *et al.,* 2016). AHP was introduced by Myers and Alpert in 1968 and developed by Thomas Saaty at Wharton School of Business inthe1970s (Kasap & Subaşı, 2017; Oktafianto *et al.,* 2018). This present study generally aims at exploring the implementation and effectiveness of the AHP method in manufacturing and non-manufacturing industries for tackling their real cases (Andreolli *et al., 2022*). Through a systematic literature review, we are informing researchers and practitioners of the precise information regarding the paradigm of companies or industries in implementing the AHP method (Khosravi, *et al.,* 2021). The Analytic Hierarchy Process (AHP) is a method of "measurement through pairwise comparisons and relies on the judgments of experts to derive priority scales" (Hermawan *et al.,* 2021).

It has been one of the most widely used multiple criteria decision-making tools." Decision making involves many different complex and difficult economic problems, the factors involved acting independently or coordinately, at the same time or at different times (Zhou, 2021). These factors are reflected in the methods of decision making, the purpose of which is to support and enhance the quality of decision making at managerial levels. The methods applied in decision making vary over time in relation to goals, situations and expected results (Gao *et al., 2022*). This evolution of decision-making methods is a direct reflection of social, economic and scientific developments especially. The development of science presents the most important factor in the evolution of decision-making methods, research into which continues unabated. Decision making is an activity that has a fairly large scope and impact on business performance. The ability to make decisions is an attribute of the human species, the exercise of which engages individuals throughout their lives (Alkharabsheh & Duleba, 2021; Nejad *et al., 2021;* Sharma *et al., 2022).*

Decisions are ubiquitous, affecting innumerable aspects of our lives. There are decisions for our families, our children, clients, employers, stockholders, patients, students, elderly parents, club members etc (Dağdeviren & Yüksel, 2008). Knowledge about decision making requires flexibility something which is readily appreciable in business and professional contexts, but is necessary when it comes to making any decision, whether it is a personal decision, a family decision, and so forth. From the totality of options, the manager must distinguish the optimum decision (Byun, 2001). The performance of businesses creates an ever-growing need for scientific knowledge. However, the quality of a decision is based on the power of the decision-making abilities in question. An optimum decision presupposes two dimensions: a temporal dimension and a qualitative dimension. In this context, decision making represents a process that is subject to planning. Planning can help to define independent goals, provide standards of measurement, transform values to actions and determine the effective use of resources (Gupta *et al.,* 2015; Lee *et al.,* 2008; Yurdakul & Ic, 2005).

Chin *et al.* (2002) depicts that lack of planning in decision making reduces effectiveness and generally leads to questionable conclusions. Planning in decision making is easier than it appears and involves an appreciation of the "time" dimension in particular the consequences of a decision are conditioned, also, by the time available. Decision making often requires discussions, which take time. Kumar and Parameshwaran (2020) stated that decision-making bodies need to know when to end deliberations, which is tricky. Deciding to end the process too early is as damaging as deciding to end it too late. "Time" defines the first out of six influential factors in decision making; the availability of time "the time available to make the decision" - must be precisely determined (Yang *et al.,* 2009). Consideration of time in decision making excludes limiting failures. Time is presented as a limiting factor in two directions. First, from the point of view of its presence in each stage of decision making; and, secondly, from the point of view of the ability of the manager to devote sufficient time to each stage of the decision-making process. This environment has been called an "anarchic environment" (Nallusamy *et al.,* 2016; Sundharam *et al.,* 2013).

Regarding the above, "the choice opportunities" are recognized with the generation of decision alternatives, the process continues with an examination of their consequences, then moves on to an evaluation of consequences in the context of objectives, and finally to a decision (Görener, 2012). This is an overly simplistic description compared to what actually happens. Other

scholars, in later periods, have found problems with the original article by Cohen et al. on the Garbage Can Model. Specifically, the program created by Cohen et al. failed to detect "three decision-making styles" (decision by resolution, decision by oversight and decision by flight). Also important in decision-making theory are Simon's theories on limited rationality (Badi & Abdulshahed, 2019; Bakir & Atalik, 2021; Chan *et al.*, 2007; Garg, 2016; Karaman & Akman, 2018; Singh, 2016).

There are important restrictions on cognition that condition human behavior, specifically: "(i) incompleteness of information (Chan & Chan, 2010); (ii) difficulty in the anticipation of the consequences (Mukeshimana *et al., 2021*); and (iii) scarce knowledge of all possible human behaviors" (Kumar *et al.,* 2015). Generally, decision making in regional countries is a routine activity post-totalitarianism. The culture of doing business is influenced by the national culture (Yüksel, 2012). The decision-making methods in centralized business cultures are based on manager experience—that is, they are intuitive methods. Business managers are inclined to be guided by them. Intuition appears as a non-sequential information-processing mode (Lokhande *et al.,* 2020). As such, intuition has various limitations. It is a process of combining expertise and know-how with an employee's instincts rather than just a series of random guesses. As a consequence of relying on intuitive methods, managers have not infrequently found themselves at a crossroads. More than ever, managers are required to change their approach to decision making by focusing on analytical methods (Badi *et al.,* 2019).

Such as statistical, econometric and mathematical methods. Decision making, for which we gather large amounts of information, has "become a mathematical science today". The mathematical methods in decision making provide fast, accurate and safe solutions (Tseng& & Lee, 2009). The quality of a decision is also conditioned by the use of mathematical methods. Therefore, some scholars have stressed that the making of optimum decisions equates to "the mathematical optimization problem" (Metaxas *et* al., 2016). Since there are numerous mathematical methods, the manager must adapt the methods to the problem that the decision is about. Decision theory represents a multidisciplinary theory that uses different methods to guarantee the quality of a decision Görener, 2012). One of the recommended methods is the Analytic Hierarchy Process (AHP). This is the method will be used in this paper. AHP guarantees quality because it has a powerful mathematical base and is to be used in the process of the evaluation and selection of alternatives (Abu-Sarhan, 2011). Many scholars are engaged

in the use of the AHP method. According to Emrouznejad and Marra (2017), "the number of publications related to the topic of AHP has increased over the last 10 years". AHP has been used in various domains business, government, military and industrial (Chan *et al.,* 2008). It has an overall value for each country, but developing countries need to use AHP for the evaluation and solution of complex economic problems from different perspectives of development. The AHP method helps decision makers find the best answer (Albayrakoglu, 1996; Jayant *et al.,* 2014; Luthra *et al.,* 2016; Zaidan *et al.,* 2015).

The benefit of this method (AHP) based on experience, intuition and also on physical data, is that it may deal with qualitative as well as quantitative aspects of a decision-making problem. Highlighted that AHP has a number of advantages, including: Its usability; ii It is an effortlessly reasonable system; iii It disentangles a troublesome issue by separating it into smaller steps; iv It does not require authentic information sets (Yang *et al.,* 2007). Over the years, AHP has evidenced a number of disadvantages, which have been studied by numerous researchers. According to Munier and Hontoria (2021), and Salvia *et al.* (2019), referring to other researchers, stressed that some of the disadvantages of this method (AHP) include the high computational requirement even for small problems, as well as its subjective nature and the fact that it relies on emotions being translated into numerical judgments, while the increased time and effort it involves demands larger numbers of pair comparisons (Atanasova-Pacemska *et al.,* 2014; Oreski, 2012).

Another disadvantage is the fact that criteria may change their value in space and time, so that pairwise comparison is the worst method for weighting. Again, based on Munier and Hontoria (2021), and Asadabadi *et al.* (2018) have highlighted that "It is a mathematically proven fact that when the order of a matrix increases to more than three, the inconsistency issue arises and increases exponentially as the number of the criteria and alternatives grows (Ezzabdi *et al.,* 2015). If CR is more than 0.1, the user is blamed for providing inconsistent comparisons". According to Elezaj *et al.,* (2021) "One of the weakest points of AHP is the difficulty in working with large problems, that is, with problems with many hierarchy levels (above 4)".

However, using the AHP method in decision making should not be avoided outright because, as Barakos and Sellek (2019), have noted, "AHP is not fawless but can be a very powerful tool if you can use it properly". "AHP is not a mathematically rigorous method developed by Saaty". Song and Kang (2016) stressed, however, that "the AHP has various weaknesses including ambiguous questions, fixed measurement scales, and varied results, depending on

the form of hierarchy structure despite the attributes themselves being unchanged". Despite the disadvantages, using the AHP method in decision making is crucial because, according to Kazibudzki and Trojanowski (2020), "Intuitive decisions are not supported by data and documentation and may appear arbitrary".

Decision making according to AHP is both a wide and complex process because AHP can be used for decision making in both the physical and social domains (Wu & Tu, 2021). Furthermore, AHP is a "hierarchical model of decision making" in that it descends from a focus, down to criteria, down further to subdivisions of the criteria and finally to the alternatives (Goswami & Behera, 2021). The most frequently used method is data envelopment analysis and the most popular integrated method is analytical hierarchy "process-goal programming" (Canco *et al.,* 2021). AHP decision making consists of three levels: the goal, the criteria which form the second level and the different alternatives at the third level of hierarchy. The influencing factors were named criteria (Amenta *et al.,* 2021). Russo and Camanho (2015) referring to other researchers, emphasized that "In general, the influence factors are denominated criteria.

However, they also were called aspects—Huang *et al.* (2008) and Hsu *et al.* (2010), attributes—Hsu *et al.* (2010), classes Rezaei *et al.* (2014), dimensions—Jiang *et al.* (2011), and Rostamzadeh and Sofian (2011), families- Vidal *et al.,* (2011), index Vafaee Najar *et al.,* (2021), and perspectives Huang *et al.* (2008)". Decision making based on AHP involves many criteria and sub criteria for ranking the alternatives to be selected from. Decision making cannot be general but is dependent on the problem in question. In the decision-making process, to achieve the goal and objectives, the first step is to choose the appropriate decision-making method that fits the problem type (Najar *et al.,* n.d; Nanang *et al.,* 2022). Range of potential methods will be used is partly conditioned by their treatment in the literature. Whether a method can be used is a matter requiring evidence derived from a specific case. In this context, it is important that empirical methods be used to investigate contemporary related phenomena to gain an in-depth understanding of the actual factors in play (Noori, 2015).

2.8 Summary

Overall, many models support the logic based on the existing context of the study on the ideology of the Adaptation of Green Value Chain Strategy in Industry Sustainability of the Cement Manufacturing Sector of Sri Lanka. The study emphasized many gaps in the theoretical and empirical review.

CHAPTER III METHODOLOGY

3.1 Chapter introduction

This chapter presents the methodological process followed in compiling the study. Accordingly, it first resented the research philosophy, approach, and strategy and opted to conduct the study in line with the leading research questions recognized. After that, it presented the study's conceptual framework as part of the variable relationships justified in the first and second chapters. The researcher has presented the hypotheses based on the direct and indirect paths mentioned in the conceptual frameworks. The study also presented empirical justification for the variable operationalization process. It has rationalized the sample selection method and the sample size concerning the study's fundamental nature as it had to deal with only two leading companies in the Sri Lankan cement manufacturing sector as the overall study population. The methods followed to analyze the data and hypotheses testing were presented at the chapter's end.

3.2 Methodological choice

Adopting the quantitative method can be a strong justification for choosing the quantitative technique. According to Crotty (2007), *the methodology* is "the strategy, plan of action, process or design lying behind the choice and use of particular methods and linking the choice and use of methods to the directed outcomes."

Carter and Little (2007) researched eco-design, green purchasing and environmental corporation. Some of the specific areas of study focused on improving product design to reduce the use of harmful products, expanding less energy throughout product conveyance, and collaborating with suppliers and customers for green packaging and cleaner production methods within these three dimensions. (Zsidisin & Hendrick, 1998).

Many studies depicted that research collects quantitative and qualitative data through surveys and interviews. The primary motive of data collection is to arrive at a consensus on the relationship between the use of Green Value Chain principles and their ability to reduce the negative impact on the environment. (Zsidisin and Hendrick, 1998; Carter & Little, 2007). According to Lee *et al. (*2012), it is critical to identify the key areas of the value chain that significantly influence the environment and conduct research to categorize the association level

between these factors. Also, research is essential to have on the organization achieving sustainability by adapting Green Value Chain principles.

Green values and principles improve an organization's overall sustainability if there is a clear understanding of what green values mean and how they interact with other aspects of the organization's activities. (Walton *et al.* 1998; Zhu *et al.* 2005). Therefore, the primary focus of the research is to construct a conceptual framework and gather both primary and secondary data of a quantitative and qualitative nature. This research specifies a deductive approach as it suggests the construction of a conceptual model which identifies how to convert the value chain to Green Value Chain principles to achieve sustainability. In order to achieve this validation, the use of a conceptual framework will be employed (Kothari, 2004).

The Conceptual Framework will be formulated based on a set of independent variables identified through literature as critical areas that govern the current value chain of the cement manufacturing industry. The testing of the Conceptual framework will focus on what areas need to be improved by Green Value Chain principles to reduce pollution in the cement industry. The conceptual framework also consists of mediating and moderating variables that are significant to the independent and dependent variables.

The research required primary and secondary data collection (Kumar & Phrommathed, 2005). Secondary data consisted of information collected by reviewing specific internal reports and published statistics of the local cement industry to identify any changes to the value chain activities. Moreover, secondary data is used to gather theoretical evidence on the green value chain. Similarly, primary data consisted of quantitative and qualitative approaches to defining specific areas, which the researcher can use to test the hypothesis and formulate information to answer all research questions.

Researchers use Creswell *et al.* (2003) state the mixed method approach to gather specific knowledge on the subject matter and simultaneously provide answers to multiple research problems. The types of data will be both quantitative and qualitative. Quantitative data will be a primary source of testing and validating the conceptual framework. Quantitative data is required to test correlation and linear regression between the independent and dependent variables (Saunders *et al.*, 2018). Correlation and linear regression will provide the criteria for

selecting specific independent variables that can be improved to create sustainable operations (Flick, 2013). Rationally, changing the value chain activities surrounding specific variables creates sustainability and supports the cement manufacturing industry's implementation of Green Value Chain principles. A qualitative approach is required by using interviews within a selected sample segment to gain a deeper understanding of the implications of converting the current to be more aligned with green values and principles (Snieder *et al.,* 2012). This study is quantitative research which uses a series of in-depth interviews. It focuses on a sample segment of critical internal and external stakeholders in the industry. The main objective is to identify how the changes in the value chain would affect the overall business operations of the future (Silverman, 2013). The narration is displayed in specific extracts of the interviews, and excerpts of quotations from the interviewee are displayed to establish the extrapolation's validity (Wiles *et al.,* 2011). Marczyk *et al.* (2010) indicated that conclusive research allows the researcher to identify and reach critical conclusions regarding primary research outcomes. The conclusive method has been used to depict meaningful conclusions through data analysis. The researcher has identified what changes can be made to enhance the existing value chain of the Sri Lanka cement manufacturing industry. Methodology governs the entire research process. The research methodology in any research setting needs to be well planned and critically analyzed to meet the research's aim and answer the research questions.

According to Creswell (2009), knowledge claims, strategies and methods are the three required elements to be planned when framing research design. Knowledge claims refer to the assumptions about how to learn and what to learn in a research study. These assumptions are called paradigms, philosophical assumptions, epistemologies and ontology or broadly conceived research methodologies (Creswell, 2009). There are three types of research philosophy such as epistemology, ontology and axiology. According to Johnson and Duberley (2003), "epistemology" can be divided into two terms. Episteme means "knowledge" or science, and "logos" means "knowledge", "information", "theory", and "account." According to Williams (2007), epistemology is "a way of understanding and explaining the method of learning the existing knowledge.

Epistemology implies what is known and how it links to reality, judging that a statement is true. In contrast, ontology asks what it is and what reality is. Ontology is concerned with the nature of reality, which means researchers' assumptions about how the world operates

(Saunders *et al.,* 2007). The values of a researcher in making judgments about research conducted and how to do it is known as axiology (Creswell, 2009). From the epistemological and ontological assumptions, the researcher selects a suitable methodology to perform the research (Creswell, 2009). Accordingly, the research design is derived to determine specific guidelines, including the research methods used (Dul & Hark, 2007). Hathaway (1995) stated that "the design of quantitative or qualitative methods is replete with assumptions concerning the nature of the knowledge and reality. When one chooses a particular research approach, one makes certain assumptions concerning knowledge, reality, and the researcher's role (Ho, 2013). These assumptions shape the research endeavor, from the methodology employed to the type of questions to be asked (Creswell, 2009; Jackson, 2013; Oliver, 2010).

In order to provide a broad picture of the research design and to determine the strategy and framework, the research onion by Saunders *et al.* (2007) is adopted here - see Figure 3.1. In the research process, the researcher must be clear on the philosophy or paradigm, the approach to and strategy for research, method choice, the time needed and finally, the techniques used for data collection and analysis. The possibility of several approaches and perspectives makes framing research design and selecting the scientific approaches challenging (Pride *et al.,* 2017). In fact, according to Kuhn (2008), no "scientific method" is generally usable among all scientists and researchers. Therefore, research designing and selecting the scientific approaches are required according to the specific area of research. In general, this thesis falls under business and social science in a broad sense. It is essential to narrow down the entire picture given in the research onion and to emphasize the current study's respective positions concerning the research onion stages (Saunders *et al.,* 2007; Saunders & Taownssend, 2016).

Meanwhile, Saunders *et al.* (2015) view deduction and induction as the two major approaches to drawing research conclusions. Although quantitative and qualitative purists convey the impression that there are rigid divisions between deduction and induction, the growing consensus among researchers seems to point towards the complementary value of these two approaches. Bell *et al.* (2022) posits that the inductive and deductive process is not mutually exclusive. Saunders *et al.* (2015) argued that combining induction and deduction within the same research piece is possible and often advantageous. Dubois and Gadde (2002) stressed that a adductive approach is a systematic combination of inductive and deductive approaches. In line with this thinking, this study is based on a deductive research approach to theory. The

deductive approach combines inductive and deductive reasoning, yet the focus is on the inductive approach (Goddard & Melville, 2004). However, the researcher used deductive reasoning to determine the extent to which brand equity can be inferred to the brand evangelism in the cable industry of the country (Munasinghe & Dissanayake, 2018). According to Bell *et al.* (2022), the deductive approach moves toward hypothesis testing, after which the principle is confirmed, refuted or modified. Saunders *et al.* (2015) argue that the deductive approach helps a researcher develop a theory and hypothesis and then test the hypothesis in reality. Saunders *et al.* (2015) argue that a topic for which there is a wealth of literature from which you can define a theoretical framework and hypothesis lends itself more readily to the deduction. This study follows a deductive approach in line with the epistemological paradigm since it investigates the existing theories in a different context, examining relationships within the defined variables (Oliver, 2010). The researcher conceptualizes the variable relationships based on empirical justifications and theoretical associations to examine the brand relationship behavior of the cable industry in Sri Lanka (Dudovskiy, 2016). As per Saunders and Taownssend (2016), positivism is a research paradigm that encourages studies to follow quantitative methods to examine the relationships among variables, whereas quantitative scales are recommended to measure the responses. Epistemology and positivism justify quantitative research methods (Denzin & Lincoln; 2008; Oliver, 2010). Accordingly, this study conceptualizes the variable relationships. In contrast, brand equity and brand evangelism are presented as a direct path whilst brand trust is framed through an indirect path. Alongside, hypotheses were framed in line with the claimed research gaps and practice-related issues in the Sri Lankan cable market. (Buil *et al.*,2013; Cooper *et al.*, 2006 *;* Delgado-Ballester, & Munuera-Alemán,2005 ; Doss, 2014; Gunawardane,*et.al.*,2016; Japutra, *et.al.*,2014; Kelani Cables Plc, 2016; Kuo & Feng, 2013;Munasinghe & Dissanayake,2017;Scarpi, 2010; Zikmund *et al.*,2013).

Research philosophy can be discussed in three significant ways: epistemology, ontology and axiology. According to Paten (2017), and Williams (2007) epistemology philosophy is "a way of understanding and explaining existing knowledge and". Epistemology implies what is known and how it links to reality and judges that a statement is true, whereas ontology asks what it is and what is reality. Ontology is concerned with the nature of reality, which means researchers' assumptions about how the world operates (Saunders *et al.,* 2007). The values of a researcher in making judgments about research conducted and how to do it is known as

axiology (Creswell, 2009). From the epistemological and ontological assumptions, a suitable methodology is selected to perform the research (Creswell, 2009). Accordingly, the research design is derived to determine specific guidelines, including the research methods used (Sekaran & Bougie, 2013).

The possibility of several approaches and perspectives makes framing research design and selecting the scientific approaches challenging (Pride *et al.,* 2017). In fact, according to Kuhn (2008), no "scientific method" is generally usable among all scientists and researchers. Therefore, a logically explained process must be conducted to conduct research. Accordingly, this study has opted for epistemology as the paradigm for framing how research questions should be addressed (Sekaran & Bougie, 2013). As per Saunders and Taownssend (2016), positivism is a research paradigm that directs studies to use quantitative methods to examine the relationships among variables, whereas quantitative scales are recommended to measure the responses. Epistemology and positivism are associated with the justification of quantitative research methods of a study (Denzin and Lincoln; 1998; Oliver, 2010).

The researcher chose positivism philosophy in the study. Because it examines the actual reality in a specific context, the cement manufacturing sector of Sri Lanka, to evaluate the green value creation process and its effect for a specific research need. Usually, positivism demands deriving the variable relationships based on the existing empirical insights or theories rather than finding new knowledge (Saunders *et al.,* 2007). Meanwhile, Saunders, *et al.,* (2015) view deduction and induction as the two major approaches for drawing research conclusions with variable links. Thus, it has selected a deductive approach to determine the variable relationships (Saunders *et al.,* 2007). Accordingly, the study was designed with a conceptual framework, whereas all the variables and measures were based on empirical justifications. Snyder (2019) defined the methodology as "the strategy, plan of action, process or design behind the choice and use of particular methods and linking the choice and use of methods to the directed outcomes. Hathaway (1995) stated that the choice between quantitative and qualitative methods focuses on several assumptions about how knowledge and reality are understood, how knowledge is acquired, and how knowledge about reality is acquired. When one chooses a particular research approach, one makes certain assumptions concerning knowledge, reality and the researcher's role (Bell *et al., 2022*). These assumptions shape the research endeavor, from the methodology employed to the questions asked (Creswell, 2009; Jackson, 2013; Oliver,

2010). The researcher used a quantitative research strategy since positivism studies need to measure, analyze and investigate the variable relationships (Bell *et al., 2022*). Thus, it developed a questionnaire as the research tool. The study was carried out as a survey to collect the data.

As mentioned earlier, this study presents its conceptual framework since it follows the positivism research paradigm and deductive approach. The researcher has justified the independent variable of green value creation and how it does link with sustainable performance within the first and sends a chapter. In contrast, the methodology chapter provides a specific narration after presenting the conceptual framework and related hypotheses. The researcher conceptualized the mediating role of Green innovation as justified in the first and second chapters.

3.3 Conceptual framework and path relationships for hypotheses development

A conceptual framework develops using research questions and hypotheses (Leshem & Trafford,2007). Therefore, the conceptual framework has to visualize the variable relationships in line with the research problem and the research questions specified in a deductive study (Bell *et al.,* 2020). Moreover, Wood (2010) mentioned that the research question, study purpose, literature review and conceptual framework must demonstrate proper consistency. A quantitative study has to be based on a conceptual framework to facilitate data analysis examining variable relationships indicated by a literature review (Sekaran & Bougie, 2013). The research questions can generate by evaluating the mediating impact which results from environmental innovation followed by the selected firms.

The researcher used previous studies to address relationships between the economic and environmental pillars of sustainability by examining the relationships between environmental management and firm performance (Ambec & Lanoie, 2008; Blanco *et al.*, 2009; Molina-Azorín *et al.,* 2009; Pandey & Pandey, 2021). The environmental innovations undertaken by firms stand for the introduction of a more environmentally friendly composition of internal processes of the firm (e.g. the usage of the heat and water recycling technologies). Environmental product innovation is the introduction of an environmentally improved or a new environmentally friendly product (e.g. products or packaging that are easier to recycle). Exploring the mediating role of environmental innovation towards the firm's performance is empirically supported.

In particular, this study has applied different measures and concepts for environmental and performance variables. Some prior research works called for an investigation of mediating variables that enable the conversion of efforts to reduce the environmental impact into benefits for the firm's performance (Blanco *et al.*, 2009; Orlitzky *et al.*, 2003). Environmental management includes all the actions carried out in a systematized way to monitor the environmental impact of the firm's activities and manage issues related to the environmental dimension (Jabbour & Santos, 2008). This study mainly chose the environmental management rather than the environmental performance variable because environmental performance results from the organizational efforts to reduce environmental impact (environmental management).

Also, it reflects the type of business activities the firm has. As per empirical support, the firm s performance and cost-effectiveness and differentiation, like appealing to consumers' preferences for 'green' products, were framed based on the firm performances generated via environmental innovations were framed on the firm's performance, (López-Gamero *et al.*, (2009; Molina-Azorín *et al.*, 2009). In brief, environmental innovations and also green value creations have the potential to improve firm performance via cost reduction and increased productivity and efficiency (Shrivastava, 1995): reduction of the costs of inputs, savings on waste treatment costs, avoiding pollution fines, and risk reduction that could also lead to a lower cost of capital (De Marchi, 2012). Some studies summarize that environmental innovation refers to new or modified processes, techniques, practices, systems and products to avoid or reduce environmental harm (Kemp & Arundel, 1998). Environmental management in a firm requires a set of implemented in-company procedures that target the continuous improvement of environmental performance by Deming's cycle (Arundel & Kemp, 2009; Shewhart& Deming, 1986).

Setting targets for the reduction of environmental impact highlights several factors in the process of environmental strategy formulation, employee training, regular measurements of environmental impact, environmental audits, managerial reviews of achieved results, taking corrective actions, Etc. (Morrow & Rondinelli, 2002). Due to the functioning of environmental management systems, the philosophy of continuous improvement of environmental performance gets incorporated into the organizational and operational structures of the firm. Employees are getting engaged in reducing environmental impact (Darnall & Edwards, 2006). When an organization's environmental management system is well developed, it penetrates the

organization, creates environmental awareness, and stimulates the delegation of resources to environmental improvements as sustainable performances. Such performances significantly reduce environmental impact (Hart & Ahuja, 1996). Redesigned production processes found within green value creation can reduce energy and water usage, prevent water, soil and air pollution, and eliminate noise. Thus, it can empirically denote the relationships between eco-friendly products and sustainable performances. (Cheng and Shiu, 2012).

As per the brief provided in the content mentioned above, the leading independent variable (IV) is the Adaptation of the green value chain (Chen & Shih, 2007). This has been rationalized with green supply chain management –green value chain activities undertaken by the firms for the green value process. (Bowen et al., 2001; Eltayeb *et al.*, 2011; Green Jr *et al.*, 2012; Lee *et al.*, 2012; Sarkis *et al.*, 2011; Tseng *et al.*, 2015; Wu *et al.*, 2015; Zailani *et al.*, 2012; Zhu *et al.*, 2005; Zhu *et al.*, 2007). The dependent variable of this study is Firm Subsumable Performances (DV). Alongside, a conceptual framework is derived as undermentioned (Berman, 2002; Holweg & Pil, 2001; Salvador *et al.*, 2002; Sharma & LaPlaca, 2005; Esty & Winston, 2006; Hawken *et al.*, 1999; Lindsay *et al.*, 2006). The role of environmental innovations undertaken by firms within the green value creation process is examined by this study as a mediating impact as empirically supported and in line with the practice gaps being claimed (Boons & Wagner, 2009; Christmann, 2000; Darnall & Edwards, 2006; López-Gamero *et al.*, 2009; McWilliams & Siegel, 2000; MolinaAzorín *et al.*, 2009; Sarmento *et al.*,2007). Accordingly, the following conceptual framework is presented, followed by the hypotheses.

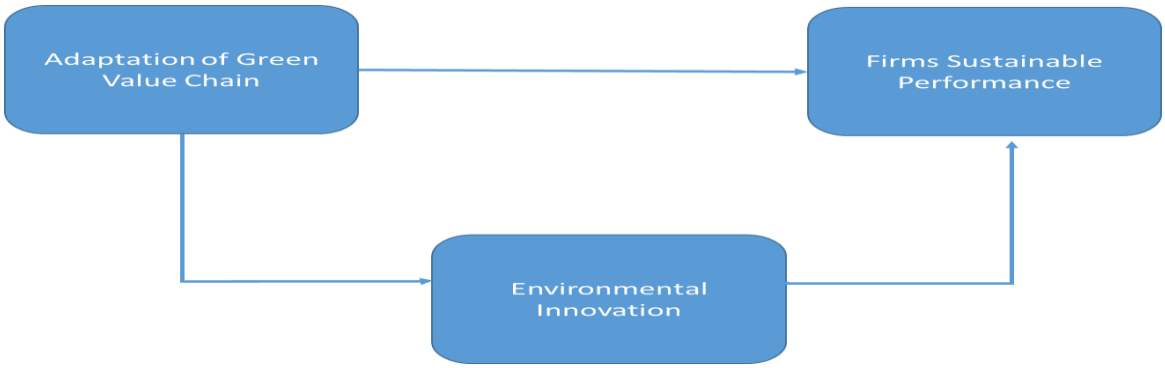

Figure 3.1: Conceptual Framework (Source: Developed by author based on previous literature)

As per the conceptual framework, the study derived the undermentioned hypotheses.

H1: Adaptation of Green Value Creation significantly influences sustainable performances of the firm

This has been supported by empirical evidence concerning the industrial sector and cement manufacturing firms.

H2: Adaptation of green value creation significantly influences the environmental innovation of the firm.

H3: Environmental innovations have a significant impact on the sustainable performance of the firm

H4: Environmental innovations mediate the impact of the Adaptation of green value creation on the sustainable performance of the firm.

3.4 Variable Operationalization

According to Babbie (2005, pp, 132-133), *operationalization* defines as the process of developing specific research procedures (operations) that ensure the results of empirical investigations align with the concepts and objects of real life. The concepts and variables in general in social studies are ambiguous and have different meanings, measures and various scales. Operationalization explains the operations that have to be performed to measure the concepts. Hence, the operational definitions are akin to the specific rules of measurements in the study (Viswanathan, 2005). Therefore, the researcher has to define the specific meanings of concepts and methods of measuring the variables in the study. Alongside, the researcher provided the variable operationalization table based on the model constructed in the conceptual framework—accordingly, concepts, variables and measures are presented herewith.

Table 3.1 Operationalization

Concept	Variables	Measures	Sources
Green Value Chain (Chien and Shih, 2007).	Adaptation of Green Value Chain Shih (2007) functions	● Waste recycling activities ● Lower level of emission ● Environmental innovative practices ● Green operational analysis procedures	Beamon, (1999) Vachon, and Mao, (2008) Tan & Zailani, (2009)

		• Continuous green improvement procedures • Green measurements procedures • Green objectives procedures	*Seven point Likert scale*
Sustainable Performance	Competitive Financial ,Environmental and Social Performance	• Profitability • Reducing Energy consumption • Reducing wastes • Avoiding fines due to violation of rules • Pollution control • Recycling measures • Clean and green operations • Effectiveness of operations • Reducing cost of materials • Product competitiveness • Market expansion • Company image improvement • Management improvements • Public Awareness	Zhu *et al.* (2005), Markley and Davis, (2007), Chavan, (2005), Tan (2015), Hervani *et al.* (2005). FIVE *Pont Likert Scale*

Environmental Innovation	Eco innovations	• End-of-pipe pollution control technology • Waste management • Clean process-integrated technology • Recycling • Clean products. • Clean-up technology	Arundel and Kemp, (2009). Kemp and Pearson (2008) FIVE point *Likert scale*

(Source: Developed by the researcher)

3.5 Research Design and Instrument

Research design is the way it is going to answer the research questions. Accordingly, research design is a blueprint that directs data collection, measurement, and analysis of data (Sekaran & Bougie, 2013). Thus, the methodology concerns why, what, from where, when, and how data is collected and analyzed (Guba and Lincon (1994, p. 108). As this study is deductive, the researcher chose the survey method as the research strategy. Accordingly, it has used comprehensive questionnaires based on variable operationalization as the primary research tool. The study used both secondary and primary data for specific purposes. It has used secondary data sources, including industry publications and policy-related papers published on environmental concerns in Sri Lanka and the market insights of the cement manufacturing sector in Sri Lanka. The main instrument was the questionnaire, which included basic demographic questions to obtain the profile data of the respondents. This study used Likert scale questions. The study used 5-point Likert scales to survey the independent and dependent variables. The researcher examined the mediating variable of environmental innovation with six items based on a 7-point Likert scale to avoid biases in responding to the questionnaire (Sekaran & Bougie, 2013).

This study used the convenient sampling method to select the sample respondents. The study had to select the two cement manufacturing companies in Sri Lanka that follow Green Value Chain functions and environmental innovations. According to the nature of this study, it had to consider the total population of the two companies that manufacture cement in Sri Lanka. The

managers and supervisors use Green Value Chain activities in an organization. Therefore, they know those functions and have a full or partial connection between planning and evaluating activities (LafargeHolcim, 2018; Tokyo Cement, 2018). As per the information accessibility received and the approachability of the relevant staff of the two companies, it has compiled the final sample, which amounted to 104 from the two companies. The samples used were from two companies that manufacture cement with green value chain activities, which measure environmental innovations (Bell *et al.,* 2022; Hair *et al.,* 2010). The table below depicts the sample selection of the two companies in Sri Lanka that manufacture cement with green value chain activities and environmental innovations.

Table 3.2: Profile in STRATA - Holcim Inc.

Profile in STRATA –HOLCIM Inc.	**Total**
Senior Management	10
Technical Mangers	15
Manufacturing or Plant Mangers	15
Supply Chain Mangers	18
Logistics Personal	17
Business Development, Chanel and Distribution Relationships	25
Total	**104**

(Source: Based on the Company Internal Details of Cement Manufacturing Companies in Sri Lanka 2017/2018)

3.6 Exploratory Factor Analysis and Data Analysis

As a quantitative study, researcher followed the descriptive statistical analysis to present the sample profile as the first inclusion of the data analysis content. It used the central tendency statistics and percentage values to present the sample details. Next, it has used the mean values and slandered deviation of the measures or items being examined under each of main three concepts and the relevant variables (Sekaran & Bougie, 2013). Researcher used tables to

present the key findings of the descriptive analysis of the items so that findings and recommendation could use that information to support the logical claims geared out of this study. It used SPSS 20 software package to do the basic statistical analysis.

Additionally, researcher used the factor analysis to conduct the exploratory factor analysis (EFA) to figure out how factor loadings are in line with the variables to be surveyed (Ho, 2013). The initial EFA was done with 25 respondents and only two items were removed within the sustainable performance namely "Profitability" and "Avoiding fines due to violation of rules" due to less than 0.5 factor loadings reported (Hair, *et.al.*,2010; Williams, 2007). Accorodngly, final quationare were used by removing those two items to conduct the main survey.Questions were formulated as per the items indicated in the operationalization table and it used 5 point Likert Scale according to the empirical justification of previous studies used those variables and scales (Arundel & Kemp, 2009;Saundars *et al.,* 2007).

3.7 Goodness of Measures

The Goodness of measures indicate preliminary rationale to execute statistical analysis (Wynne *et al.,* 2022). As undermentioned, there are few matters to be employed within the goodness of measures. Researcher has justified some main requirements come under goodness of measures in this contents. First, it has followed the data screening process to find whether the database has any outliers that may subsequently provide wrong interpretation to overall findings. Thus, the researcher used the SPSS-20 package to find the outliers and 2 cases removed (Hair, *et.al.*, 2010). As per that 4 outlier cases were treated. Thus, final analysis was done based on 102 respondents.

Thereafter, it had to run a normality test to confirm items of the variables meet multivariate normal distribution (Diotaiuti *et al.,* 2021). This study used the requirements specified by previous studies as testing Kurtosis and Skewness to confirm the normality (Bajpai & Bajpai, 2014). Researcher employed the rule of standardized values between + 3 and -3 as the acceptable range of Skewness and for Kurtosis +7 to -7 was the range to claim the normality (Dhammika *et al.,* 2012). The results of normality test have been explained in the next chapter to confirm the possibility of executing parametric tests.

Next, it has undertaken the tests to confirm the reliability of the instruments used to measure the concept and variables found in this study. (Sekaran and Bougie, 2013). Confirming the reliability means that internal consistency or homogeneity of the items of a construct (Sekaran and Bougie, 2013, p.229). Accordingly, Cronbach's Alpha technique was used to explain the internal consistency (Perry Hinton *et al.*, 2004). As per Kline (2005), Cronbach's Alpha values for the variable should be greater than 0.7 to claim reliability so that confirming internal consistency. Additionally, study conducted construct/composite reliability (CR) test to justify the consistency of the constructs found in the developed research model claiming indicators measure what it means to measure (Straup, Boudreau and Gefen, 2004). The accepted norm is 0.70 to say for composite reliability of the measures (Ho, 2013).

It is supposed to indicate the internal validity and external validity of different instruments

Employed for a study when it comes to data collection for thevariables to surveyed (Sekaran and Bougie, 2015, p.225). Validity communicates that instruments are measuring the obvious matter to be measured (Ho, 2013). One of the options to claim the validity is content validity explaining it has uses the most suitable and accurate measurements, and expert panel could justify that it uses the mist suitable measurements to measure the variables found in a survey. (Hair, et.al.2010; Ho, 2013). Thus, researcher got the views from 3 academics attached to University of Kelaniya, Sri Lanka to get the views on the measurements and the wordings used before executing the final survey satisfying content validity (Rubuo, Berg-Weger, Table and Rauch (2003).

Additionally, it used convergent validity to justify the internal consistency of the measurements to verify particular it measures the same construct when a model has different variables and constructs (Hair, et.al.2010; Ho, 2013). This was done with the use of factor analysis and how factors are grouped with the particular variable based on the loading value of the EFA. It refers that achieving 0.5 of factor loading value is satisfying the convergent validity of the measurements. The results of the convergent validity are also presented in the next chapter

3.8 Testing Model Fit

It is essential to test the Measuring model fit with the dataset when structural equation modelling (SEM) is executed to test the hypotheses based on the variable paths (Hair et al.,

2010; Ho,2013;). It has to run the model even few times to confirm the model fit before executing the final tests of hypotheses. Meanwhile, Cangur and Ercan (2015) justified that model fit testing of SEM is crucial to examine the causal relationships of a models. There are many model fit indices, but essential requirements exist for a study to test the model fit for executing SEM (Ho, 2013).

First, Chi-Square value indicates a model fit index, referring how the degree of discrepancy y between the sample and fitted covariance matrices should be established in a model (Hu and Bentler, 1999; Kline, 2005). Secondly, the indices of Root Mean Square Error of Approximation (RMSEA) must be confirmed within the zone to confirm the sample size requirement for model fit (Browne and Cudeck, 1993). Moreover, studies suggest that the Goodness of Fit Index (GFI) is required to justify the model fit before examining the output of SEM (Kline, 2005). The Comparative Fit Index (CFI) is the other model fit indicator specified as one of the essential requirements to test hypotheses based on the SEM derived through a CFA (Ho, 2013). Likewise, the undermentioned table presents the leading model fit indices used to rationalize the model fit of the CFA generated by using AMO-23 software.

Table 3.3 Model fit

Indices	Rule of Thumb	Source
Root Mean Square Error of Approximation (RMSEA)	Values between 0.05-0.08 Less than 0.06	Cangur and Ercan, (2015) Hu and Bentler (1999) Ho (2013)
Normed Chi-squire to test model discrepancy ($x^{2/}$/df) (CMIN/DF)	Less than 3 Between 1-3	Kline (2005)
Comparative Fit Index (CFI)	More than 0.9	Bentler (1990)
Goodness of Fit Index (GIF)	More than 0.9	Schermelleh-Engel and Moosbrugger (2003) Joreskog and Sorbom (1989), Hu and Bentler (1999)

(Source: Sekaran and Bougie, 2013**)**

3.9 Testing Hypotheses

This study is designed with a model of both direct and indirect paths as mentioned in the conceptual framework and hypotheses are developed accordingly including a mediating test.

Hypotheses testing of this study is based on the (SEM) since it is the best option of examining hypotheses derived on both direct and indirect paths of a same model (Byrne, 2010; Hair, et.al.2010). However, this study used covariance-based techniques (CB-SEM) over that variance-based partial least squares (PLS-SEM) method. CB-SEM finds best fitting when it requires to do CFA when the study is based on theory. This study uses variables relationships addressing to the empirical justifications whilst theoretical associations are also used with theoretical gaps (Hair, Ringle and Sarstedt, 2013). And also this model includes three different sub models where it requires to run the CFA separately before compiling the final model for testing hypotheses based on SEM output. Conclusively, researched used CB-SEM as per the justifications made and AMOS-21 software was occupied to run the CFA based on the dataset generated by SPSS-21 software.

Hypotheses were tested based on the output statistics of the SEM produced by AMOS- (Gabrial and Patel, 2014; Hair, et.al.2010). The final model of CFA was executed to get the SEM estimates after model fit improvements are done for the default models. The mediating impact was tested followed by the Bootstrapping method (Ho, 2013). The next chapter presents the output of the data analysis including key explanations and the methodological justifications used.

3.10 Data Analysis

Data analysis has to be backed by the methods demanded by the research strategy. Accordingly, quantitative research works should select the analytical methods to address the set objectives (Ho, 2013; Sundram, et.al.2013). This study follows the IBM SPSS 20 package as the

Quantitative statistical software since social science studies heavily use it for effective data analysis methods (Sekaran and Bougie, 2015; Sweet and Marting, 2008). Researcher used descriptive statistical analysis to present the basic profile data of the sample being used. It used mean v values, standard deviation values and frequencies to report the central tendency of the data set whilst percentage analysis is used for comparative explanations when reporting sample

profile (Sweet and Martin, 2008; Yuan, 2005). In addition, researcher reported correlations valued as fundamental inferential statistics inclusively when interpreting the SEM output (Ho, 2013, Hair, et.al.2010).

3.11 Summary

In summary the methodology creates the full framework pertaining with the development of the overall research design and is oriented an s the foundation of the chapter 04 for the data analysis. Accordingly, the development of the research synthesis and the integrated literature and its synchronization with the methodology and the data analysis are evident on the concept of recognizing the main derivate of the research objective in chapter 05.

CHAPTER 4 DATA ANALYSIS and FINDINGS

4.1 Chapter Outline

This chapter plans and clarifies the findings and presents an analysis of the data. The chapter denotes the results of the data analysis and the successive clarifications of the conclusions of the main study. The analysis also covers the hypotheses testing, the research questions and the study's objectives to derive relevant variables for realizing Sustainable Performance. The researcher analyzed this data using the statistical package of social science (SPSS) 21 and the Analysis of Moment Structure (AMOS) 21 package to analyze data. Also, the researcher included the mediation analysis.

Furthermore, the chapter shows the statistical output of demographic factors, constrictions, and descriptive statistics. The study used various demonstrative tools to analyze the data, including bar charts, graphs and frequency tables. The researcher had collected data trust the following in attention.

4.2 Data Cleaning and Screening

Previously analyzing the data, checking the data and settings for faults is significant. The initial stage of the data analysis is pre-analysis, which includes screening and cleaning the data comprising three basic levels.

1) Checking for errors

2) Finding the errors in the data file

3) Amending the error in the data file.

Throughout the data collection period, the researcher checked all error samples and concentrated on the missing data.

4.3. Assumption of Analysis

The study used multivariate analysis namely multicollinearity, outliers, linearity, normality and homoscedasticity, must be met (Hair et al., 2006).

4.3.1. Assessment of Normality

The normality test is the most important statistical assumption in multivariate analysis (Hair et al., 2010).

The study used the histograms and standard probability plot (Quantile - Quantile plot) to examine the distributions' shape for each variable (Tabachnick and Fidell, 2007; Hair et al., 2010). Hair et al. (2010) note that the visual examination of data permits the scholar to fully understand the essential characteristics of individual variables and associations between variables in a simple picture over the use of graphics.

According to the graphical output of the normality test, the variables were likely to proceed from a normal distribution because the skewness and kurtosis values were not zero. Consequently, normality is accepted between -3 and + 3 for Skewness, while it ranges between -7 and +7 for Kurtosis (Byne, 2010). The output of normality was in an acceptable range.

Table 4.1 Skewness and Kurtosis Values

	N	Skewness	Kurtosis
	Statistic	Statistic	Statistic
GVC1	102	.017	.249
GVC2	102	-.667	.296
GVC3	102	-.328	.558
GVC4	102	-.355	.129
GVC5	102	-.210	.315
GVC6	102	-.612	.915
GVC7	102	.044	.156
SP1	102	-.324	.328
SP2	102	-.080	.674
SP3	102	-.317	.026
SP4	102	-.049	.218

SP5	102	-.249	.523
SP6	102	-.052	.598
SP7	102	.062	.911
SP8	102	-.859	.722
SP9	102	-.660	.440
SP10	102	-.765	.498
SP11	102	.334	.192
SP12	102	-.224	.482
EI1	102	-.214	.136
EI2	102	-.115	.264
EI3	102	-.145	.030
EI4	102	-.218	.423
EI5	102	-.472	.170
EI6	102	-.308	.163
Valid N (listwise)	102		

(Source: SPSS output calculated by researcher)

4.3.2. Assessment of Linearity

Linearity supposes that "the mean standards of the result variable for each increment of the predictors lie along a straight line" (Field, 2009, p.76). Linearity is an essential assumption of multivariate techniques as it signifies the correlations and the linear relationships between variables (Hair et al., 2010). In line with Hair et al. (2010), the most common mode to assess the linearity of the relationships is to classify nonlinear forms in the data by investigative scatterplots of the variables. Then, the researcher observed the scatterplots with a straight line, demonstrating the linear relationship. Thus, the nonlinear patterns were absent from the data. The researcher examined the residuals by running a simple regression analysis. These, therefore, indicated the linearity of the relationships.

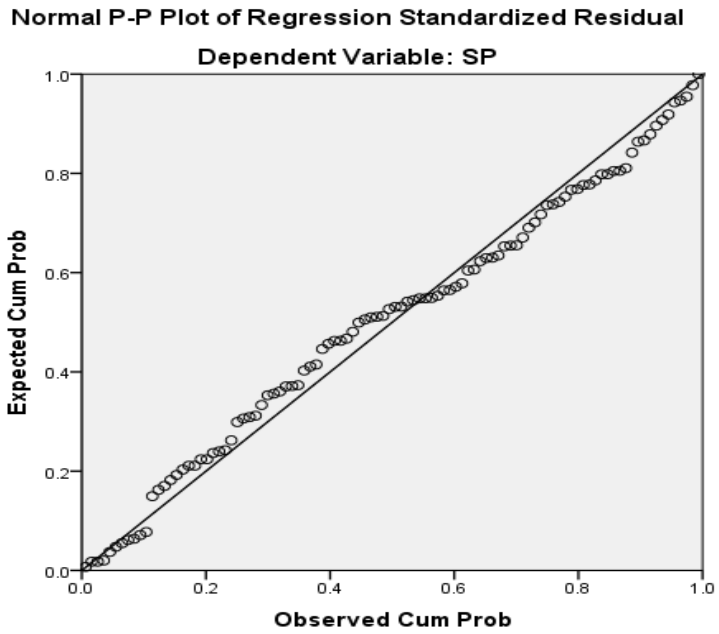

Figure 4.1: Linearity (Source: SPSS output calculated by researcher)

4.3.3. Assessment of Homoscedasticity

Homoscedasticity means that the variability in the scores for variable X should be alike for all values of variable Y. This can be checked by investigating the scatter plot. Heteroscedasticity is the contrast to homoscedasticity. A visual inspection of the scatter plots did not display any pattern of growth or a decrease in residuals, i.e., no visible patterns of residuals were noted. This displays that homoscedasticity does exist for the independent variables of this learning.

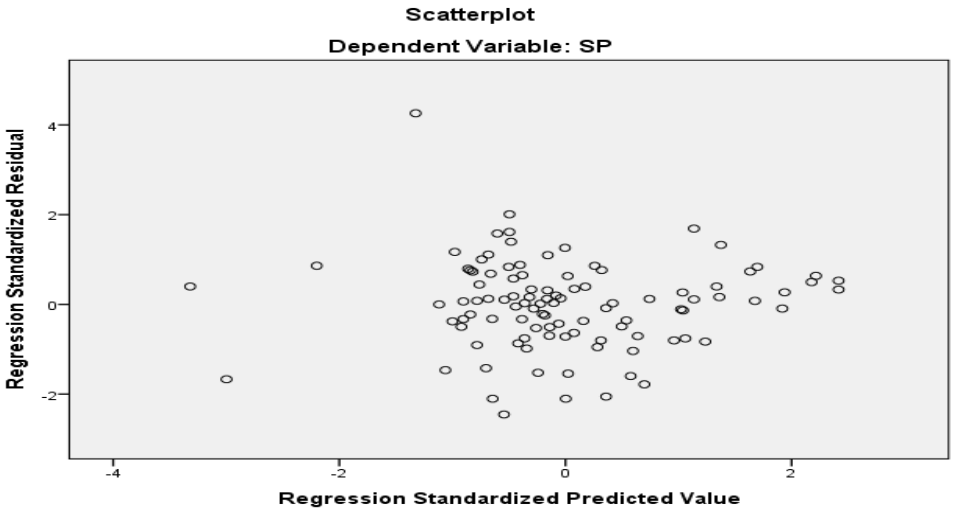

Figure 4.2: Homoscedasticity (Source: SPSS output calculated by researcher)

4.3.4. Assessment of Multicollinearity

Multicollinearity is the calculation of the "extent to which the other variables can explain a variable in the analysis" (Hair et al., 2010, p.93). In order to contact the degree of multicollinearity, the investigator first skimmed the inter-correlation between variables in the correlation matrix (the R-matrix). Therefore, to determine the impact of multicollinearity on the results, variance inflation factors (VIFs) and tolerance statistics acquired from the SPSS program were observed (Hair et al., 2010). In this study, the tolerance values were above 0.998 (Hair et al., 2010; Menard, 1995). In addition, none of the VIFs values was above 10.

Table 4.2 Multicollinearity

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	1.460	.250		5.840	.000	.964	1.956		
	GVC	.452	A	.571	8.762	.000	.350	.555	.706	1.417
	EI	.307	.053	.379	5.813	.000	.202	.412	.706	1.417

(Source: SPSS output calculated by the researcher)

4.3.5. Detection of Outliers

The study used outlier analysis to examine whether any variables had "a score very different to the rest" (Field, 2009, p.97; Hair et al., 2010). In line with Arena (2009), the scholar sensed outliers by investigative box-whisker diagrams. Consequently, the graphs showed some outliers in the analysis. Hair et al. (2010) note that it is necessary to remove the outliers because they reflect a non-representative of any explanations in the population. Nevertheless, the scholar definite does not eliminate the outliers because the holding of the outliers is a method "to confirm generalizability to the whole population" (Hair et al., 2010, p.67). Besides, the

researcher did not have evidence that they were “truly unusual and not representative of any explanations in the population” (Hair et al., 2010, p.67).

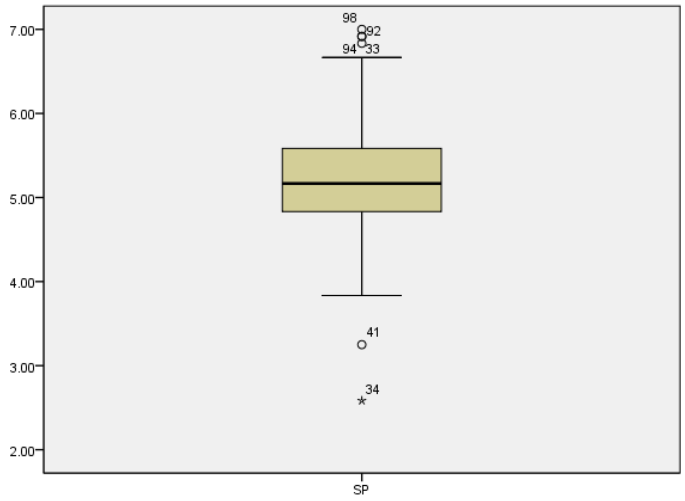

Figure 4.3. Outlier (Source: SPSS output calculated by the researcher)

4.3.6 Common method bias

The evidence in this study was self-reported and grouped using a similar methodology for measuring all variables while indicating that common method bias is a problem. Hair et al. (2010, p.764) stated that the standard method bias specifies that “covariance between measured items is influenced by the fact that some or all of the responses are together with the same type of scale”.

For this determination, the study might have been pretentious by common method bias (Hair et al., 2010). For instance, the data examination presented above ensures the achievement of the required data assumptions to accomplish multivariate analysis. The researcher examined the general statistical properties of data sets, sample adequacy, missing data analysis, outlier analysis, normality analysis, homoscedasticity, linearity and multicollinearity, and the common method bias. Overall, the analysis has met the required assumptions.

4.4. Response Rate

The data collection process took about three months to complete. It started in January and ended in March 2020. Out of the 104 questionnaires distributed, ninety-eight (98%) responded

to the data collection. Conversely, the researcher ignored fourteen questionnaires due to the repeated marking of the scale‘s points and incomplete responses by the respondents.

However, the researcher completed the study survey with 102 questionnaires coded and used for data analysis.

Table 4. 3 Response Rate

Item	No.	%
Total questionnaires distributed	104	100
Total questionnaires received	104	100
Total usable responses	102	98.07

(Source: SPSS output calculated by the researcher)

4.5. Respondent Profile

Table 4.4 indicates the respondents' profile of the sample of 104 respondents. The demographic variables are known as categorical variables. Of the 104 respondents, the majority (75.795%) are males. Almost 46.07%of the respondents' age is between 36 to 45 years old. Moreover, about 49.02% of the respondents were professionally qualified. Meanwhile, most respondents (40.19%) were middle-level managers, 58.88% worked in the operational division, and 47.07 per cent of respondents experienced three to six years. Most respondents were highly engaged in green McCormick (2007) activities (55.88%).

4.6. Reliability Analysis

To measure the reliability among the variables green value creation, environment innovation and sustainable performance. Below, the study showed the outcomes in the techniques of tables. As can be seen, Table 4.5 displays an alpha (α) >0.7. Green Value Creation shows an alpha (α) of 0.904, and Environment Innovation displays an alpha (α) of 0.870. Sustainable Performance shows an alpha (α) value of 0. 895. The sufficient number for alpha (α) is >0.6 (Bryman and Bell, 2011). However, it should preferably be >0.7, which leads to a pattern among the responses within the questionnaire and how the respondents supposed the statements (Hair et al., 2007).

Table 4. 4 Reliability Values

Variable	No. of items	Alpha Value
Green Value Creation	07	0.904
Environment Innovation	06	0.870
Sustainable Performance	12	0.895
Total	25	

(Source: SPSS output calculated by the researcher)

Table 4. 5 Respondents profile

Respondent's profile	Number	Percentage %
Gender		
Male	77	75.49
Female	25	24.51
Age		
18-25	7	6.86
26-35	26	25.49
36-45	47	46.07
46 above	22	21.57
Highest Academic Qualification		
High school	5	4.90
Degree	35	34.31
Professional	50	49.02
Postgraduate	12	11.76
Carrier level respondent		
Top Management	17	16.67
Middle level	41	40.19

Senior Executive	33	32.35
Executive	11	10.78
Functional field of respondent		
Oper/Tech	57	58.88
Supply	32	31.37
Busi.Divi.	7	6.86
Fin.and Admin	6	5.88
Experience in present company		
1-3 years	7	6.86
3-6 years	47	47.07
6-9 years	36	35.29
Above 9 years	12	11.76
Engage with green activities		
Very high	31	30.39
High	57	55.88
Average	14	13.72
less	0	

(Source: SPSS output calculated by the researcher)

4.7. Descriptive statistics for main Variables

Descriptive statistics such as mean and percentage were used to measure the percentage of variables and also described the mean and standard deviation of endogenous and exogenous variables.

Table 4.6 displays the mean figure for Green Value Creation (M=5.0308; SD=0.96966), Environment Innovation (M=4.8334; SD=0.946), Sustainable Performance (M=5.2206; SD=0.76829) The mean analysis displays that the Sustainable Performance has the highest level and Environment Innovation is the lowest mean of the variable.

Table 4.6 Descriptive Statistics

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Green Value Creation	102	2.00	7.00	5.0308	.96966
Sustainable Performance	102	2.58	7.00	5.2206	.76829
Environment Innovation	102	2.17	7.00	4.8334	.94631
Valid N (listwise)	102				

(Source: SPSS output calculated by the researcher)

4.8. Exploratory Factor Analysis

Factor Analysis is a data decrease practice that is mainly used for the determination of classifying the essential dimensions in multivariate data analysis. This study uses functional Factor analysis; which researchers typically use to confirm conceptualizing a construct of interest. The purpose would be to eliminate all highly correlated or dismissed variables from the current data file and change the outstanding data with a comparatively smaller number of variables, often known as factors. Respectively, the respondent will indicate their replies to these Green McCormick (2007) Value Creation, Environment Innovation, and Sustainable Performance.

The Kaiser-Meier –Olkin (KMO) value factor study was used to check for the model adequacy. KMO value of greater than 0.7 is reflected to be good (Hair et al., 2012). The average variance extracted (AVE) must be at least 50% and the factor loading specifies the asset of the relationship between the item and the latent construct and so, is used to determine the convergent and discriminant validity of the scales (Hair et al., 2006). Nunnally (1978) the minimum factor loading must be higher than 0.5. If all these situations are met, then the mean of the item can be calculated, saved and used in more analysis (Hair et al., 2012).

EFA is used for data exploration in order to generate hypotheses. It is a practice that contributes to researchers defining the structure of factors to be observed. Accordingly, it is a process used when the relationship between latent and observed variables is also unidentified or undefined. The distinct feature of EFA is that the factors are derived from theory, and these elements can

only be named after factor analysis is proficient. EFA can be done without knowing the number of factors that are present and occur or which variables belong with which constructs (Hair et al., 2006).

Table 4.7 Factor Loading and KMO values

No	Item	Factor Loading
	Green Value Creation – KMO = 0.910 Bartlett's: Sig. = 0.00 58%	
GVC1	My company adopts Waste recycling activities	0.862
GVC2	My company adopts environmental innovation practices within the operations	0.774
GVC3	My company adopts methods for Lower level of emission	0.687
GVC4	My company adopts Green operational analysis procedures in different sections	0.816
GVC5	My company adopts Continuous green improvement procedures	0.719
GVC6	My company adopts Green measurements procedures	0.795
GVC7	My company adopts Green objectives related procedures in different sections	0.658
	Environment Innovation – KMO=0.840 54%	
EI1	My company applies End-of-pipe pollution control technology in overall processes	0.568
EI2	My company applies Waste management methods in overall processes	0.748
EI3	My company applies Clean process-integrated technology in overall processes.	0.847
EI4	My company applies recycling methods in overall processes.	0.754
EI5	My company applies clean product methods in overall integrated functions	0.785
EI6	My company applies clean-up technology for overall functions and activities.	0.763
	Sustainable Performance-KMO=0.864 65%	

SP1	Due to green value practices, my company is able for Reducing Energy consumption	0.789
SP2	Due to green value practices, my company is able for Reducing wastes	0.799
SP3	Due to green value practices, my company is able to meet Pollution control	0.695
SP4	Due to green value practices, my company is able to meet Recycling measures	0.797
SP5	Due to green value practices, my company is able to meet Clean and green operations	0.796
SP6	Due to green value practices, my company is able to effective Operation of materials	0.779
SP7	Due to green value practices, my company is able to reduce cost of materials	0.868
SP8	Due to green value practices, my company is able to obtain Product competitiveness	0.784
SP9	Due to green value practices, my company is able to do Market expansion	0.838
SP11	Due to green value practices, my company is able to obtain Management improvements	0.785
SP12	Due to green value practices, my company is able to obtain good public awareness	0.798

(Source: SPSS output calculated by the researcher)

Table 4.7 shows the 24 principal axis factoring items (PAF) items. Initially, the researcher tested the suitability of data for factor analysis. Inspection of the correlation matrix revealed the presence of many coefficients of 0.3 and above. The Kaiser-Meyer-Olkin value was 0.90, exceeding the recommended value of 0.6 (Kaiser; 1970, 1974).

The factor loadings of the items in the Green McCormick (2007) Value Creation construct were between 0.658 and 0.862. The total item represented seven items. The six items represented in the Environment Innovation questionnaire were derived from the output (Table 4.7). The factor loadings scores were between 0.568 and 0.847.

Accordingly, the factor loadings of each item were between 0.695 to 0.868. Meanwhile, the researcher removed item SP1 due to low factor loading. Consequently, the reliability of the

new factor set reporting AVE and construct reliability (CR) is undermentioned before executing the CFA.

Table 4.8 Results of AVE and CR of Factors for Exploratory Factor Analysis

Construct	Number of Factors	AVE	CR
Green value creation	7	0.81	0.90
environment innovation	6	0.56	0.88
Sustainable performance	11	0.50	0.94

(Source: SPSS output calculated by the researcher)

The above value represents the AVE and CR values for the constructs. The AVE values of all constructs were greater than the significant value of 0.5, and the CR value showed a higher value than the AVE value. Hence the analysis shows no issue of convergent validity.

4.9. Confirmatory Factor Analysis

CFA is comparable to EFA in some respects and is reasonably different. CFA includes examining the relationship between latent (theoretical construct) and observed (indicators) constructs (Tabachnick and Fidel, 1996). CFA does not use statistical outcomes to determine the number of factors and loadings compared to EFA. Here, the scholar must specify the number of factors within a set of variables and which factor each variable loads highly on before computing the results (Hair et al., 2006). Thus, CFA does not assign variables to factors. Nevertheless, the researcher has to make this assignment before getting any results.

CFA is used to study convergent and discriminant validity by assessing the measurement model developed to test each of the main variables in this study. Researchers commonly use two approaches in evaluating the measurement model's validity, testing each construct autonomously where each latent variable is conducted independently (Garver and Mentzer, 1999) or testing all constructs collected at one time (Cheng, 2001).

Evaluating the Confirmatory Factor Analysis model fit entails associating the projected covariance matrix with that detected. Numerous different indices are accessible to evaluate

model fit. Then they generally fall into one of three categories: absolute fit indices, incremental fit indices, and parsimony fit indices (Hooper, Coughlan, and Mullen 2008).

Absolute fit indices determine how well the sample data fit the a priori model (McDonald and Ho 2002) and include chi-squared ratio, Root Mean Square Estimate of the Approximation (RMSEA), Goodness of Fit (GFI), and the Standardized Root Mean Square of the Residual (SRMR). Incremental fit indices refrain from spending the chi-squared statistic in isolation, comparing the chi-squared statistic to a baseline model. Incremental indices include the Normed-Fit Index (NFI) and the Comparative Fit Index (CFI). Finally, parsimony fit indices are suitable for use in complex, nearly saturated models to compensate for (and penalize) the complexity of the model. This study applied the following fit indices.

The chi-square statistic measures the relative difference between the sample and fitted covariance matrices. Typically, the statistic divides through the degrees of freedom to minimize the effects of sample size. Though there is a lack of consensus, values less than 5.0 would typically indicate a good model fit (Wheaton, Muthen, Alwin, and Summers 1977).

The RMSEA expresses how well a model with optimally chosen parameter estimates would fit the covariance matrix. This metric is sensitive to the model's estimated parameters and favors parsimony. RMSEA consider range between 0.0 and 1.0, with 0.0 indicating perfect model fit. The RMSEA is sole among fit indices due to the skill to calculate a confidence interval around its value (Hu and Bentler 1999).

This study also contains values for the CFI statistic for model assessment. CFI can range between 0.0 and 1.0, with higher values signifying a better fit. A typical cut-off value of 0.95 or more is symbolic of a good model fit (Hu and Bentler 1999)

The GFI statistic computes the proportion of variance accounted for the projected population covariance and can range between 0.0 and 1.0, with higher values representing a better fit. A typical cut-off value of 0.95 or more is symbolic of a good model fit (Kline 2005).

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The GFI statistic computes the proportion of variance accounted for the projected population covariance, and can range between 0.0 and 1.0 with higher values representing better fit. A typical cut-off value of 0.95 or more is symbolic of good model fit (Kline 2005).

4.9.1 Assessing the initial measurement model for Green Value Creation

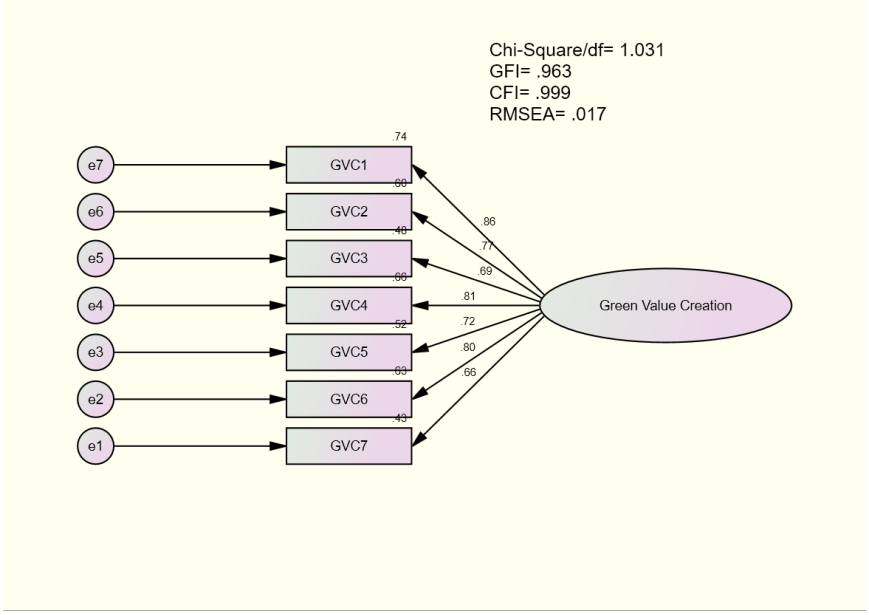

Figure 4.4: Assessing the initial measurement model for green value creation (Source: AMOS output taken by the researcher)

The model fit indices showed a poor fit (CFI, REMSEA, GFI and Chi-square\df) in the initial measurement model for green value creation. (Chi-square =1.031, GFI= 0.963 CFI=0.999, RMSEA=0.017) Therefore the model fits the data sufficiently. In the test of multivariate normality, the critical ratio of multivariate Kurtosis value was 7.848, which is >5. Hence the assumption of multivariate normality was not met. In the bootstrap analysis using 1000 resamples, the Bullion-Stein p value was 0.719,>0.05.

Table 4.9 indicates the regression weights—items in green value creation. Therefore, the model correctness is adequate. The minimum factor loading 0.658 AVE value was 0.58, which is >0.5, and the CR value was 0.90. The CR value was more significant than the AVE value. Hence there is sufficient convergent validity. The regression weight and AVE, CR of the item in the green value creation construct are below.

Table 4.9: Regression Weight and AVE value and CR value for Green Value Creation

		Variable	Estimate	AVE	CR
GVC7	<---	Green Value Creation	.658		
GVC6	<---	Green Value Creation	.796		
GVC5	<---	Green Value Creation	.723		
GVC4	<---	Green Value Creation	.812	0.58	0.90
GVC3	<---	Green Value Creation	.693		
GVC2	<---	Green Value Creation	.771		
GVC1	<---	Green Value Creation	.861		

(Source: AMOS output taken by the researcher)

4.9.2 Assessing the measurement model for Environment Innovation

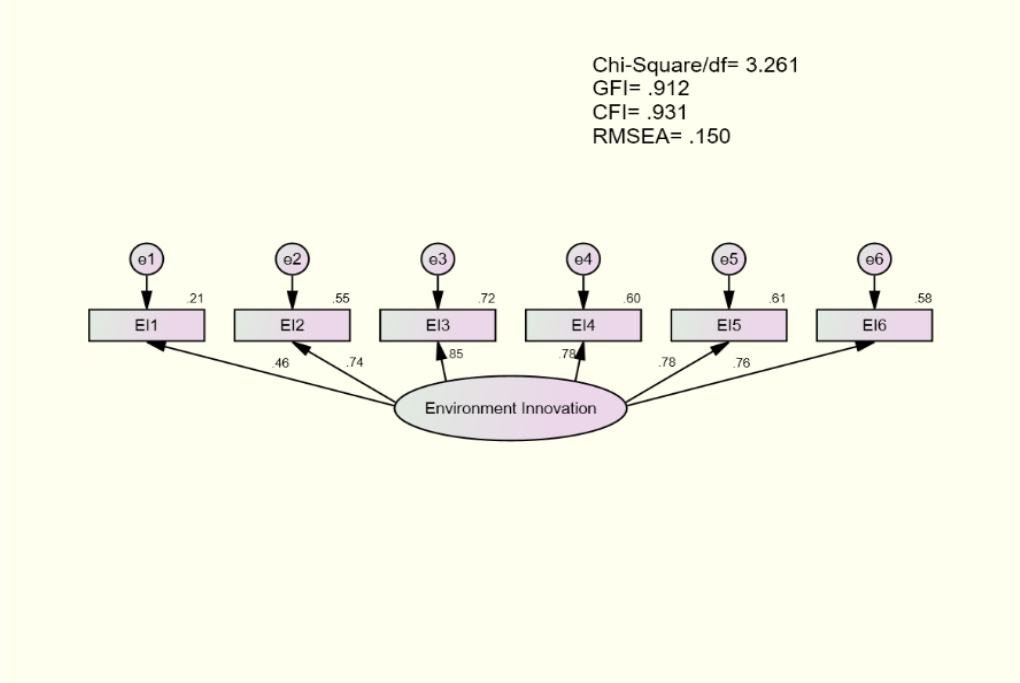

Figure 4.5: Assessing the initial measurement model for Environment Innovation (Source: AMOS output taken by the researcher)

The model fit indices specified a poor fit (CFI, REMSEA, GFI and Chi-square\df) in the initial measurement model for Environment Innovation. The model can be enhanced by correlating the item below.

4.9.3 Final measurement model for Environment Innovation

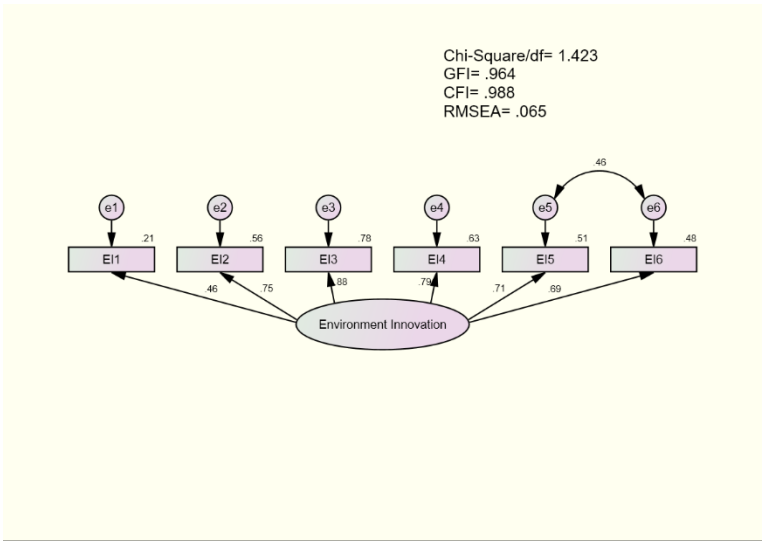

Figure 4.6: Assessing the final measurement model for Environment Innovation (Source: AMOS output taken by the researcher)

The final model of the Environment Innovation construct showed better fit to the data (Chi-squre/pdf =1.423, GFI= 0.964 CFI=0.988, RMSEA=0.065). Therefore, the model fits the data satisfactorily, and EI5 and EI6 were correlated, and no further modifications were required.

In the test of multivariate normality, the critical ratio of multivariate Kurtosis value was 4.228, which is <5. Hence the assumption of multivariate normality was met. Table 4.10 shows environmental innovation's regression through **AVE and CR values.** Items in environment innovation. The minimum factor loading 0.562 AVE value was 0.54, which is >0.5. Moreover, the CR value was 0.87. The CR value is more significant than the AVE value. Hence there is sufficient convergent validity. The regression weight and AVE. CR of the item in the environment innovation construct below.

Table 4.10 Regression Weight and AVE value and CR value for environment Innovation

		Variable	Estimate	AVE	CR
EI1	<---	Environment Innovation	.562		
EI2	<---	Environment Innovation	.747		
EI3	<---	Environment Innovation	.881	0.54	0.87
EI4	<---	Environment Innovation	.792		
EI5	<---	Environment Innovation	.714		
EI6	<---	Environment Innovation	.692		

(Source: AMOS output taken by the researcher)

4.9.4. Assessing the measurement model for Sustainable Performance

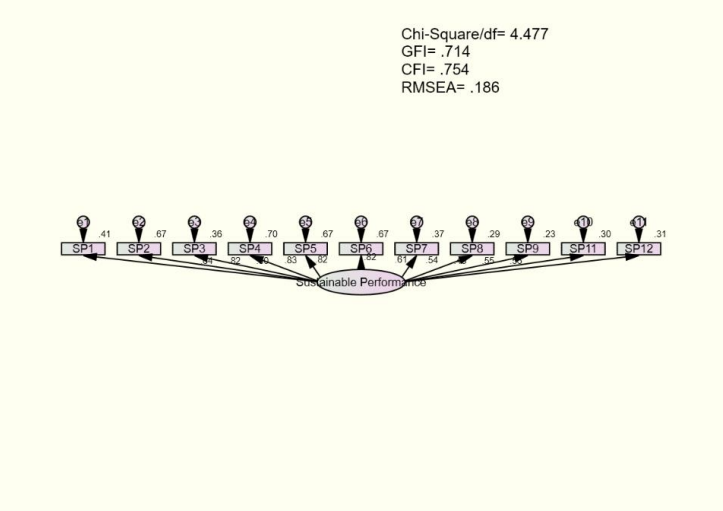

Figure 4.7: Assessing the initial measurement model for Sustainable Performance (Source: AMOS output taken by the researcher)

The model fit indices showed a poor fit (CFI, Chi-square\df, GFI, RMSEA.) in the initial measurement model for sustainable performance. The model can be enhanced as follows.

4.9.5. Final measurement model for Sustainable Performance

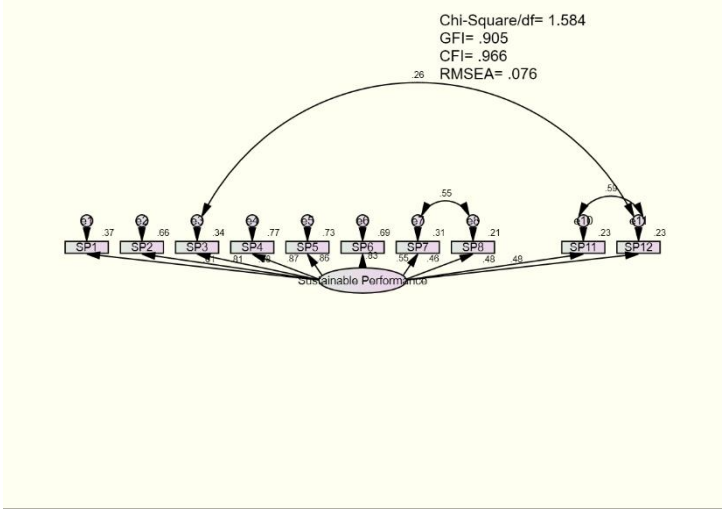

Figure 4.8: Assessing the final measurement model for Sustainable Performance (Source: AMOS output taken by the researcher)

The final model of the Sustainable Performance construct displayed better fit to the data (Chi-square =1.584, GFI=/ 0.905 CFI=0.966, RMSEA=0.076). The SP9 was removed, and some items were correlated. Therefore, the model fits the data satisfactorily, and no further modifications were required.

In the test of multivariate normality, the critical ratio of multivariate Kurtosis value was 3.396, which is <5. Hence the assumption of multivariate normality was met. The model correctness is adequate. The regression weights are shown in table 4.11 items in sustainable performance. The minimum factor loading 0.651 AVE value was 0.50, which is >0.5. Moreover, CR Value is 0.92, showing a higher value than the AVE value; hence there is adequate convergent validity. The regression weight and reliabilities of the item in the sustainable performance construct are below.

Table 4.11 Regression Weight and AVE value and CR value for Sustainable Performance

		Variable	Estimate	AVE	CR
SP1	<---	Sustainable Performance	0.707		
SP2	<---	Sustainable Performance	0.813		
SP3	<---	Sustainable Performance	0.682		
SP4	<---	Sustainable Performance	0.875		
SP5	<---	Sustainable Performance	0.856	0.50	0.92
SP6	<---	Sustainable Performance	0.833		
SP7	<---	Sustainable Performance	0.685		
SP8	<---	Sustainable Performance	0.651		
SP11	<---	Sustainable Performance	0.662		
SP12	<---	Sustainable Performance	0.662		

(Source: AMOS output taken by the researcher)

4.10. Final Measurement model for the framework

The above section described that a single measurement model had been established for each construct of the study's independent, dependent, and mediator variables. This segment developed the measurement models to fit the data better. The overall measurement model tested 23 items related to the four primary constructs: seven items from green value creation, 06 items from environment innovation, and ten items from sustainable performance. Model modification according to the modified indices proposed by deleting and covariant item (Ho, 2013).

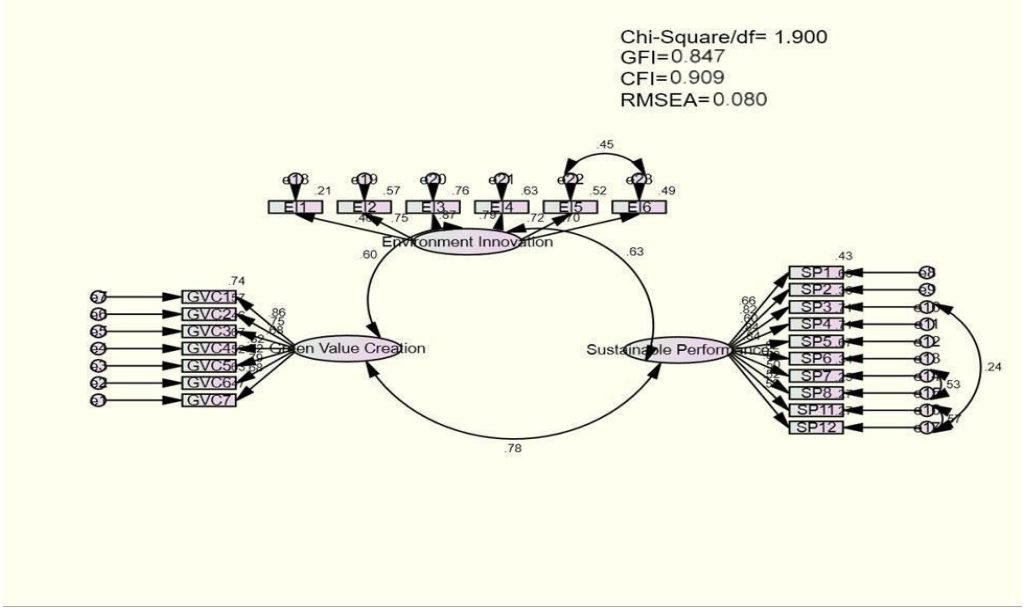

Figure 4.9: Final Measurement Model for the Framework (Source: AMOS output taken by the researcher)

Table 4.12 Final Measurement Model fit

Fit indices	Accepted Value	Result
Chi-Square/df	<5	1.900
CFI	>.9	0.909
REMSEA	<.08	0.080
GFI	>.9	0.847

(Source: AMOS output taken by the researcher)

The overhead guides all are in acceptance level GFI value also close to the getting value of >.9 Goodness of fit indices only provide statistical reverence (Bentler and Chou, 1987, Anderson and Gerbing 1988: Byme, 2010, Hair et al., 2010) Beside this statistical significance there is also methodological and theoretical justification in the social science studies those ought to be remembered by the researchers before declining a model.

4.10.1 Correlation for Latent Construct

Examining the final measurement model's correlation demonstrated a strong positive relationship between green value creation and sustainable performance (.776). Other relationships also appear as positively correlated.

Table 4.13 Correlations for latent construct

Variables			Estimate
Green Value Creation	<-->	Environment Innovation	.595
Sustainable Performance	<-->	Environment Innovation	.625
Sustainable Performance	<-->	Green Value Creation	.776

(Source: AMOS output taken by the researcher)

4.10.2 Discriminant Validity in Final Measurement Model

The three latent constructs are different because the correlations between latent constructs (greater than 0.8 or 0.9) suggest a lack of discriminant validity (Cunningham 2008). The maximum correlation between green value creation and sustainable performance is 0.776. In this case, there is no problem with the discriminant validity.

4.11. Structural Equation Model

This study engaged structural equation modeling (SEM) with the maximum likelihood method to analyze the data and test hypotheses. In analyzing the data, the researchers first directed a confirmatory factor analysis (CFA) to define the model's strength. The study used three indexes such as to stimulate the model fit. They are “Absolute Fit Index” (Goodness of Fit/GoF and Root Mean Square Error of approximation/RMSEA), “Incremental Fit Indexes” (Normed Fit Index/NFI and Comparative Fit Index) and “Parsimonious Fit Indexes” (Normed Square and

Parsimony Goodness-of-Fit Index/PGFI). The cut-off value for GFI and CFI is above 0.9; the normed square is less than 5, and RMSEA is less than 0.08 (Kline, 2005). Upon the completion of CFA, further analysis was testing both structural models.

The measurement model conferred earlier is to construct ways of measuring concepts reliably and validly. Besides, the measurement model is a severe step in developing an SEM model. The next step in SEM is to postulate the structural model by conveying relationships from one construct to another based on the suggested theoretical model. Overall, this technique permits the analysis of groups of independent variables and dependent variables concurrently (Hair et al., 2006; Hoyle, 1995). SEM provides information on the model fit and variance explains (*R2*) that helps explain or foresee the variance in variables.

4.11.1 Stages of Structural Equation Modeling

Path and a whole SEM are measured in result a model that parsimoniously fits the data and can deliver the best explanation of the connection of the model.

4.11.1.1 Model Specification

The researcher formulated the hypothesis and the relationship between variables through a critical literature review. These procedures were energetic as they supported the reasonable hypotheses' grounding to specify the SEM's theoretical relationships. Path and a whole SEM are measured in result a model that parsimoniously fits the data and can deliver the best explanation of the connection of the model.

4.11.1.2 Assessment of Model Fit

Absolute fit, model parsimonious and incremental fit are the goodness of fit measures employed to examine the model fit. The goodness of fit has been explained clearly in chapter three.

4.11.1.3 Model Re-Specification and Modification

Academics might wish to study possible changes to expand the theoretical explanation or the goodness of fit. If the measurement model holds an insupportable fit, standardized residual and modification indices can help the researcher to determine why the model is not accepted. Garver and Mentzer (1999) oppose that when examining standardized residuals and modification indices, theoretical thoughts should be used as the primary consideration in making model adjustments.

In examining standardized residuals, large residuals' patterns should be considered. A large residual will be over 2.00 and 2.58 and are measured as statistically significant at the .05 level (Garver and Mentzer, 1999). Significant residual displays a substantial prediction error for a pair of pointers. Items with cross-loading or corresponding to more than one factor displays large residuals with disparate items from different elements and should be removed from the model. If the adjustment is implemented, the model should then be re-specified and re-evaluated after each modification (Schumacker and Lomax, 1996). Modification indices (after this MI) are very supportive in determining how to modify the measurement model. A substantial modification index value of 7.88 is replicated as a significant model enhancement (Garver and Mentzer, 1999). However, Hair et al. (2006) command that modification indices of roughly four or more will expand the model meaningfully by freeing that particular corresponding path.

The most extensive MI indicates the most significant enhancement in fit. These items should be assessed for adjustment first, if and only if the modification is reliable with a priori theory or can be taken substantively (Bryne, 2001). The model is similar to the standardized residual modification and should be re-evaluated after each re-specification through MI (Garver and Mentzer, 1999).

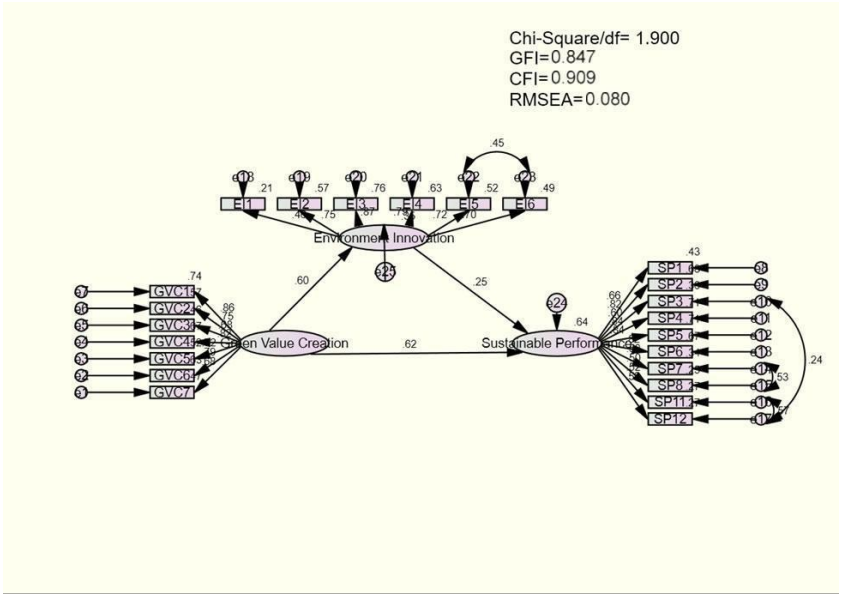

Table 4.14 summary of goodness of fit to the Structural Equation Model

Fit indices	Accepted Value	Result
Chi-Square/df	<5	1.900
CFI	>.9	0.909
REMSEA	<.08	0.080
GFI	>.9	0.847

(Source: AMOS output taken by the researcher)

The result obtained from overall goodness of fit statistics and parameter estimate of the hypothesized model was within acceptable fit as tabulated in table 4.14.

The normed chi-square was 1.900, less than 5, CFI was 0.909, which is almost close to .90 and RMSEA of 0.080, which is less than 0.08. Moreover, GFI is 0.847, close to 0.9 judging from the fit indices; "Normed Chi-square" and RMSEA suggested a good fit. The value of CFI and GFI, however very close to the required status. The goodness of fit indices only provides statistical deference (Bentler and Chou, 1987, Anderson and Gerbing, 1988: Byme, 2010, Hair et al.,2010). Besides this statistical significance, there are also methodological and theoretical explanations in social science studies that ought to be remembered before declining a model.

In Figure 4.10, based on the modification index of CFA, the measurement model of exogenous and endogenous as the examination of the hypothesized model affirmed the constructs of green value creation, environment innovation and sustainable performance of the hypothesized paths. In SEM, factor analysis and hypotheses are tested in the same analysis.

4.11.2. Squared Multiple Correlation

The model output in Figure 4.10 displays the model explained in a substantial portion of the variance in all the endogenous variables (multiple square correlations). Table 4.15 indicates that the exogenous variables (green value creation) jointly explained a 35% variance in sustainable performance. Then, environment innovation and green value creation collectively explained 64% variance in sustainable performance.

Table 4.15 Squared Multiple Correlation Results

Endogenous variable	**Squared Multiple Correlation (SMC) = R2**
Environment Innovation	0.35
Sustainable Performance	0.64

(Source: AMOS output taken by the researcher)

4.12. Results of Hypotheses Testing

Subsequent the recommendation of Anderson and Gerbing (1988), this examination uses a comprehensive, two-stage analysis. Firstly, the measurement model was confirmed using the confirmatory factor analysis, and then structural equation modeling was performed based on the measurement model of endogenous and exogenous to estimate the fit of the hypothesized model to the data.

The measurement model which stipulates and tests the relationships between the observed measures and their fundamental constructs, provides a confirmatory assessment of construct validity (Bentler, 1978). The structural model then tests the straight causal relationships among the latent constructs, as posited by the Anderson and Garbing's (1982; 1988) theory. Completing the model-building task through a two-step procedure is believed to be an enhanced approach over a one-step analysis (Anderson and 180 Gerbing, 1988). The confirmatory analysis of each dimensions were carried out to confirm the construct of green value creation, environment innovation, and sustainable performance.

The empirical results will now be discussed for each hypothesis in an orderly manner. In this study, all the hypothesized relationships were supported based on the SEM results. The path estimates the hypothesized testing in the model.

Table 4.16 Hypothesis testing

Variable			Estimate	S.E.	C.R.	P	Label
Environment Innovation	<---	Green Value Creation	.401	.110	3.631	***	
Sustainable Performance	<---	Environment Innovation	.341	.152	2.238	.025	
Sustainable Performance	<---	Green Value Creation	.566	.124	4.556	***	

(Source: AMOS output taken by the researcher)

Table 4.17. Standardized Estimates

Variable			Estimate
Environment Innovation	<---	Green Value Creation	.595
Sustainable Performance	<---	Environment Innovation	.253
Sustainable Performance	<---	Green Value Creation	.625

(Source: AMOS output taken by the researcher)

Maximum likelihood estimates of hypotheses analysis in table 4.16 imply a few parameters in this study. But, table 4 .17 below demonstrates the standardized regression weights display the relationship of variables with the estimate values in the estimate column as fit indices and parameter estimate of the hypothesized model.

Three hypotheses meet the objective of this study. Chapter four developed one mediating hypothesis to test the relationship among variables. The mediating relationships were also verified in this hypotheses model. The result has presented in table 4.16, and table 4.17 addresses the hypotheses set earlier; therefore, four hypotheses developed in this study will be further presented in the ensuing section of this research.

4.12.1 H1 There is a significant relationship between Green Value Creation and Sustainable Performance

The relationship between green value creation and sustainable performance is the first hypothesis test in this study. Table 4 .16 indicates that the relationship between green value creation and sustainable performance is measured to determine the significant P and Critical

Ratio (CR). As defined earlier, the Critical Ratio is more extensive than 1.96, and if the p is significant, the hypotheses become valid. In this study, the C.R. value is 4.556, bigger than 1.96, and the p is significant. Therefore, hypothesis is proven valid. Overall, the regression weight for green value creation in Achieving Sustainable Performance significantly differs from Zero at 0.001.

The parameter estimate links with standardized regression weight (green value creation and sustainable performance) to affirm a sufficient result. Table 4.17 shows the path coefficient of sustainable performance is 0.625, which is statistically significant. Thus, green value creation has a significant relationship with sustainable performance. Therefore, H1 is accepted after the evaluation.

Table 4.18 Decision for Hypothesis one

Variables			**Estimate**	**S.E.**	**C.R.**	**P**	**SRW**	**Conclusion**
Sustainable Performance	<	Green Value Creation	.566	.124	4.556	***0.625		Supported

(Source: AMOS output taken by the researcher)

4.12.2. H2 There is a significant relationship between Creation and Environment Innovation

Relationship between green value creation and environment innovation is the second hypothesis test in this study. Table 4.16 indicates the relationship between green value creation and environment innovation measured by significant level P and Critical Ratio (CR) as defined earlier. Critical Ratio is bigger than 1.96 and p is significant the hypotheses become valid. In this study the C.R. Value is 3.631 which is bigger than 1.96 and p is significant, therefore, hypotheses is proven valid as such it can be concluded that the regression weight for green value creation in Achieving environment innovation is significantly different from Zero at 0.001 level. (Two tailed).

The analysis showed that, the parameter estimate links with standardized regression weight (green value creation and environment innovation). According to Table 4.17, whereby path coefficient environment innovation is 0.595 which is statistically significant. Thus indicates

that green value creation has a significant relationship with environment innovation. Therefore, H2 is accepted.

Table 4.19 Decision for Hypothesis two

Variables			Estimate	S.E.	C.R.	P	SRW	Conclusion
Environment Innovation	<	Green Value Creation	.401	.110	3.631	***	0.595	Supported

(Source: AMOS output taken by the researcher)

4.12.3 H3 There is a significant relationship between Environment Innovation and Sustainable Performance

The relationship between environment innovation and sustainable performance is the third hypothesis test in this study. Table 4.16 indicates the relationship between environment innovation and sustainable performance measured by significant level P and Critical Ratio (CR). The critical Ratio is more extensive than 1.96, and if p is significant, the hypotheses become valid. In this study, the CR Value is 2.238, bigger than 1.96, and the p is significant. Therefore, the hypothesis is proven valid. Overall, the regression weight for environment innovation in achieving sustainable performance is significantly different from Zero at 0.001 level. (Two-tailed).

The parameter estimate shows the standardized regression weight between environment innovation and sustainable performance. According to table 4.20, the path coefficient between environment innovation and sustainable performance is 0.253, which is statistically significant and thus indicates that environment innovation has a significant relationship with sustainable performance. Therefore, H3 is accepted.

Table 4. 20 Decision for Hypothesis three

Variables			Estimate	S.E.	C.R.	P	SRW	Conclusion
Sustainable Performance	<	Environment Innovation	.341	.152	2.238	***	0.253	Supported

(Source: AMOS output taken by the researcher)

4.13 The Mediation Role of Environment Innovation

Partially mediation happens when just the initial three stages are met, and the connection between the independent and dependent variables is as yet significant. The mediator (environment innovation) is said to completely mediate the first relationship when the impact of one factor on the reliant variable is zero after the mediator is controlled.

4.13.1 H4 Environment Innovation mediate with the Green Value ration and Sustainable Performance

This section reports the mediating effect of environment innovation to sustainable performance. The direct and indirect effect were computed using AMOS 21. (Cheung and Lau, 2008). This study takes the indirect effect of green value creation on sustainable performance.

Table 4. 21. Indirect Effects - Lower Bounds (PC) and Upper Bounds

		Lower Bound (95%)			**Upper Bound (95%)**		
Variables	Green Value Creation	Environment Innovation	Sustainable Performance	Variables	Green Value Creation	Environment Innovation	Sustainable Performance
Environment Innovation	.000	.000	.000	Environment Innovation	.000	.000	.000
Sustainable Performance	.069	.000	.000	Sustainable Performance	.409	.000	.000

(Source: AMOS output taken by the researcher)

Indirect effects analysis using 1000 bootstrap resamples method (Cheung and Lau, 2008). The 95% confidence interval for the indirect effect of green value creation on sustainable performance lower bound represents 0.069, and the upper bound represents 0.409. The value of 0 does not fall within this interval. The value represents the positive effect. Hence there is a mediating impact. The direct path from green value creation to sustainable performance is also significant. The mediator covers the Baron and Kenny Procedures. Hence, environment innovation partially mediates the relationship between green value creation and sustainable

performance. The higher the environment innovation level, the lower the effect of green value creation on sustainable performance.

Table 4.22 Decision for Hypothesis four

Hypothesis		Conclusion
H4	The Environment Innovation mediate with the relationship between Green Value Creation and Sustainable Performance	Supported/Partially mediate

(Source: AMOS output taken by the researcher)

Table 4. 23 Summary of Hypotheses Testing

H (x)	Hypotheses	Finding
H1	There is a significant relationship between Green Value Creation and Sustainable Performance	Supported
H2	There is a significant relationship between Green Value Creation on Environment Innovation	Supported
H3	There is a significant relationship between Environment Innovation and Sustainable Performance	Supported
H4	Environment Innovation mediates with the Green Value Creation on Sustainable Performance	Supported/Partially Mediate

(Source: AMOS output taken by the researcher)

4.14 Summary

In direct, the primary survey review data findings are presented based on structural equation modeling and hypotheses testing. The study examined the fundamental information, which keeps the end goal to prepare the data for the confirmatory factor analysis (CFA). The estimation demonstration and the structural model were assessed based on 102 cases. The researcher analyzed multi-factor analysis before confirmatory factor analysis and the compulsory information presumptions. As shown by the investigation, the prerequisites were contented. The researcher examined model fit and reliability, and validity. According to the

analysis, the model fitted sound with the data. The reliability and construct validity were sustained after playing out every one of the analyses. The measurement scales have attractive measurement properties.

This study declared the examination of the hypothesized model utilizing the goodness of fit measurements. The significant level of factor loading cooperation between all factors in the model affirmed environment innovation's mediating effect (Hair et al., 1998) in the connection between green value creation and sustainable performance. Path analysis and hypotheses testing demonstrate the total direct and indirect effects of factors' interaction, which shows the goodness of model fit of the hypothesized model. The consequences of SEM in evaluating the validity or the empirical relationship between green value creation and sustainable performance were positively connected. The study declared environment innovation as the mediating variable in the hypothesized model. This section closes with a partially mediated model.

CHAPTER 5 DISCUSSION and CONCLUSION

5.1. Introduction

This chapter considers the results of the previous chapter with empirical contrasts and the support from the theory offered in the literature review chapter. The researcher provided the information necessary to develop the main concepts and in-depth discussions of the exploratory stage. The findings and the explanations for the exposed relationships are discussed by reconsidering the research instrument and considering the probable impacts of the scope of the procedures adopted. This chapter includes an overview of the findings of the hypothesis testing.

Consequently, the study has discussed the influences of aspects of green value creation on sustainable performance, green value chain towards environment innovation and the influence of sustainable performance. Then mediating effects of environment innovation are discussed. The researcher has discussed the study's theoretical, managerial, and practical implications. Lastly, the study presented the recommendations, limitations and research directions in the conclusion chapter.

5.2. Overview of the Study

The main objective of the study was to look at the “effect of the Green Value chain on Sustainable Performance in Cement industry in Sri Lanka”. The empirical outcomes additionally uncovered the significance of environment innovation and how it governs in relation to the context of the study. Upgrading environment innovation would have impact on sustainable performance. Green value chain being intangible in nature causes it considerably more hard to measure (McCormick2007 and Shih, 2007).

This examination likewise adds to a developing body of literature on green value creation, environment innovation and sustainable performance which are essential for managing the industry. The mediating part of environment innovation and the future suggestions through this study would be auspicious and exceedingly significant for the cement industry in Sri Lanka (McCormick2007).

These are essential areas that continue unanswered in the local cement industry due to the lack of research. Usually, industrial sector brands and business models in Sri Lanka find empirical research insights referring to branding, consumer responses and the business value procedures applied (Munasinghe and Dissanayake, 2018). Sustainability-connected value practices are found in the cement industry of Sri Lankan industrial sector companies but need serious courtesy to enhance it.

Consequently, it has empirically supported to postulate that measures of the green value chain are almost in line with the application content of the green value. This study also considered the green value chain as the core of green value chain Adaptation functions per the explanations provided in the aforementioned empirical review. Building material manufacturing organizations' green value creation broadly links with green supply chain additions and operations interaction. The main reason is for outsourcing activities to get excellent and sustainable results. (McCormick, 2007).

5.3. Key finding of demographic characteristics

The demographic features cover gender, age, highest educational qualification, carrier level respondent, functional field of respondent, experience and engagement with green activities. This section has provided a summary of the key findings. In this study, the gender of the sample, the majority are male Managers and Supervisors working in the cement industry in Sri Lanka. The value represents 77%. The data shows that the majority of employees were within the age group of 35-45 years (46.07%). The data shows that most employees have a “Professional Qualification” (49.02%) and most of the employee's working experience of nearly “3-6 years” (47.07%). Most of the employees were “Middle-Level Managers” (40.19%). Most employees were working in the “Operation Divisions" (58.88%). The employees have adopted green activities (55.88%). The analysis of the demographic factor is reasonable to assume the majority of employees are Middle Ages and have degree-level qualifications with three to five years of experience.

5.4. Descriptive statistics on Green Value Creation, Environment Innovation and Sustainable Performance

The research focuses on three main variables: green value creation, environment innovation and sustainable performance. The researcher examined the green value creation, environment innovation and sustainable performance of respondents using a questionnaire.

Combining the numeric survey questions for green value creation, a mean was calculated for the whole concept of green value creation. The mean value was high, with the highest recorded mean value M=5.0308 on a seven-point scale and the standard deviation SD=0.96966, demonstrating that the respondents replied soundly. It implies that the respondents consider themselves good green value creation knowledge in the cement industry in Sri Lanka.

When looking at the survey questions regarding environment innovation, the mean was M=4.8334, and the standard deviation was SD=0.946. Hence, the employees encountered environmental innovation and replied positively. The lowest mean value compares to the other two variables. Regarding sustainable performance, Employees feel they are performing well in the industry.

This study reports that the mean value of sustainable performance was M=5.2206. The highest mean value compares to the others. The research questions got positive answers and reported the standard deviation as SD=0.76829.

5.5. Discussion of Findings

This section reviews the findings as discussed in chapter 4. The researcher has outlined the research question and research objective of every construct. A summary of data collection through 391 questionnaires will be discussed and summarized.

5.5.1. Green Value Creation and Sustainable Performance

Table 5.1 summarizes the research question and research objective to understand “Green Value Creation on Sustainable Performance of employees in Sri Lankan Cement Industry” by using the hypotheses and concluded summary of previous studies to support the findings obtained for this Construct.

Table 5.1 Green Value Creation and Sustainable Performance

Research Question	Research Objective	Findings
What is the impact of Green Value Chain and Sustainable Performance?	To examine the impact of Green Value Creation and Sustainable Performance.	H1- Supported by data

(Source: Developed by the researcher)

As it refers to in the literature review chapter, the researcher postulates the hypotheses above, addressing empirical gaps and academic support. Green value creation has a significant positive association with Sustainable performance. Subsequently, H1 was supported. This hypothesis contributes to the practice-related issues that prevail in involvement in the sustainable performance of employees in the cement manufacturing industry context. This study highlights the critical performance issues and challenges found within the cement industry as an influential sector within the manufacturing scope in many countries, including Sri Lanka concerning green value functions toward sustainable financial and market performances (Annual Report of Holcim Lanka, 2017; Munasinghe and Dissanayake, 2017; Knight and Jenkins, 2009; Revilla and Knoppen, 2015).

The relationships between the economic and environmental support of sustainability are addressed as per the lessons done by previous authors examining the relationships between environmental management and firm performance (Ambec and Lanoie, 2008; Berchicci and King2007; Blanco et al., 2009; Molina-Azorín et al., 2009).

Within the research study context, sustainable performance is the cost reduction, growth of market shares and increment of profit. A green value chain can significantly reduce the costs of material purchased, energy consumed, waste generated, and avoidance of fines due to violations against regulations. It can positively affect a corporation's sustainable performance and improvement in net sales (Zhu, Q. et al., 2005, Markley, M.J. and L. Davis, 2000).

Economic performance comprises profitability, income growth, market share growth, and productivity rise (Zhu and Sarkis, 2004). A justifiable approach can lead to internal cost savings, open new markets and find beneficial uses for waste (Tsoulfas and Pappis, 2006). Acceptance of green value creation can have a positive effect on corporation costs. Green value

chain adoption can cut the cost of energy consumption, decrease the cost of waste action and discharge, and avoid fines in the case of environmental accidents (Zhu and Sarkis, 2004). Green values also enhance corporate image, competitive advantage, and marketing experience (Rao and Holt, 2005), resulting in improved performance. The researcher measured the organizational performance of diverse academics using different components. For instance, Zhu et al. (2005) examined green value chain pressures, practices and performance in Chinese firms; De Giovanni and Esposito Vinzi (2012) inspected environmental management and sustainable performance; Green Jr et al. (2012) discovered green value chain practices and firm performance proving positive association using components as environmental, operational and economic performance; Wittstruck and Totenberg (2012)

Therefore, it is evident that the concept of green value creation must be studied when determining the sustainable performance of the employees of any organization. The concept of green value creation cannot be avoided as the research objective is to understand the of the high performance of the employees in the cement manufacturing industry in Sri Lanka,

5.5.2. Green Value Creation and Environment Innovation

Table 5.2 summarizes the research question and objective to understand employees' green value creation and environment innovation in Sri Lankan Cement Manufacturing Industry. Overall, the researcher used the hypothesis and concluded the summary of previous studies to support the findings obtained for this construct.

Table 5 2 Green Value Creation on Environment Innovation

Research Question	Research Objective	Findings
What is the impact of Green Value Creationand Environment Innovation?	To evaluate the impact of Green Value Creation and Environment Innovation	H2- Supported by data

(Source: Developed by the researcher)

Environment innovation is a variable that has an impact on green value creation. According to the literature review, researchers hypothesized the direct path between green value creation and environmental innovation to examine the adaptation of green value creation resulting in environmental innovation. Green value creation has a significant positive association with

environmental innovation. Subsequently, H2 was supported. This hypothesis addresses the empirical research gaps.

Green innovations by suppliers and a company's environmental performance were also confirmed (Large, Thomsen 2011). In a recent study, Rostamzadeh *et al.* (2015) demonstrated a laptop manufacturer in Asia which aims to assess green supply chain management (green value chain) indicators for its practitioners and suppliers. Through a thorough literature review, they confirmed the importance of green value creation in terms of eco-innovation throughout the entire supply chain.

Many studies observed the management of the green supply chain focusing on the supplier selection processes and green innovation as a general concept (Zhu *et al.* 2008; Wu *et al.* 2011). Nonetheless, lack of studies available regarding the environmental performance followed by green practices, which this study justified the research gap, both theoretically and practically.

Precisely, environmental value creation considers a presence of a certified environmental management system such as ISO 14001 or Eco-Management and Audit Scheme (EMAS) like in the revision of Rehfeld *et al.* (2007). This way of measurement is disapproved by, e.g. Ziegler and Nogareda (2009) and Wagner (2007b). The literature review indicates how firms should measure and promote their environmental performance with indigeneity bias produced by the reverse causality between environmental value creation and environmental innovation. They endorse not relying on the way used measures of environmental management certification (if a firm introduced ISO 14001) but on a measure reflecting the implementation of a wide range of environmental value-creating practices. Also, certified ISO 14001 does not specify developed unceasing improvement capabilities (certification could be a symbolic gesture), as the absence of an ISO 14001 certificate does not indicate the nonappearance of the functioning environmental value creation. Henceforth, this follows Wagner's (2007b) recommendation and usage of a range of environmental value creation practices to measure the functioning of green value creation.

Hence, it is evident that the concept of green value creation must be studied when determining the environmental innovation of the employees of any organization. The study did not avoid the concept of green value creation as the research objective is to understand the antecedents

of the high performance of the employees by adopting green practices in the Cement Manufacturing industry in Sri Lanka.

5.5.3. Environment Innovation and Sustainable Performance

Table 5.3 summarizes the research question and objective to understand environmental innovation on the sustainable performance of employees in Sri Lankan Cement Manufacturing Industry. Overall, the researcher used the hypothesis and concluded the summary of previous studies to support the findings obtained for this construct.

Table 5.3 Environment Innovation and Sustainable Performance

Research Question	Research Objective	Findings
What is the impact of Environment Innovation and Sustainable Performance?	To investigate the impact of Environment Innovation and Sustainable Performance	H3- Supported by data

(Source: Developed by the researcher)

In this investigation, environmental innovation has an impact on sustainable performance positively. Subsequently, H3 was supported. According to the research problem and the main research questions rationalized with the support of empirical arguments, researchers postulated the hypothesis to examine how far environmental innovation is on sustainable performance.

Many studies about the relationship between environmental innovation and performance support that successful eco-innovations enhance and improve organizational performance. (Cheng, Yang and shew, 2014) justified the benefits of Eco-innovation in the Taiwan industry sector and found a positive relationship between environmental innovation and organizational performance. (Lozano, 2015) stated clearly from literature review the positive relationship between environmental innovation and organizational performance.

Green products and processes innovation decrease the negative influence on the environment and increase firms' competitive advantage (Porter and Van Der Linde, 1995). Chen et al. (2006)

and Chen (2008) reflected how green product and process innovation affect competitive advantage and the green image of an organization. Noci and Verganti (1999) examined this through a qualitative case study. Chen et al. (2006) started a survey in the information and electronics industry to study how green product and process innovations affect competitive advantage. Numerous studies on environmental innovation display a positive role in that cost savings motivate cleaner production technologies in particular (Frondel et al., 2007; Horbach, 2008). Environment innovations can result from other economic bases, such as increasing market share or reducing costs. As can be seen from the explanations above, the contribution of environmental innovation to firm performance has also been known (Christmann, 2000; Klassen and Whybark, 1999). There are positive relations between environmental innovation and firm performance in the following dimensions: return on investment, market share, profitability, and sales (Cheng and Shiu, 2012). Taylor (1992) suggested that firms embark on green management and environmental innovation to improve environmental performance and fulfil customers' demands to boost corporate image between regulators and the citizens.

Environment innovations occupied by a firm can like sustainable results via environmentally friendly products caused through a green friendly manufacturing process. It also creates novelties and customer value creation (López-Gamero et al., 2009; MolinaAzorín et al., 2009). This will enable firms to gain advantages on improved product quality and price premium significant to market share. Furthermore, environmental innovations offer room for interest in firm image and stakeholder satisfaction as sustainable performances (López-Gamero et al., 2009; MolinaAzorín et al., 2009).

Environmental innovations produce an important sustainable outcome for an organization by reshaping the production functions, minimizing energy use and wastage, diminishing pollution and adding value to the general model of the business process (Cheng and Shiu, 2012). These improvements can improve firm performance via cost reduction and increased productivity and efficiency (Shrivastava, 1995).

Environmental innovation emphasizes product (re)design and improvement that leads to a decrease in environmental impact. Environmental innovation allows the manufacturing of more environmentally friendly products. These products demand environmentally conscious customers. Then environmental innovation is a tool to differentiate the product. Advantages

that pertain to a customer valuing environmental friendliness as product quality increases with innovation (López-Gamero *et al.*, 2009; Molina- Azorín *et al.*, 2009) are enhanced product quality, a product price best and a higher market share. Environmental product innovation is also probable to contribute to the firm image; since environmental improvements of the product connect to external stakeholders, the firm's commitment to environmental impact decreases. All the advantages mentioned above are differentiation advantages. So this hypothesizes that environmental product innovation positively impacts firms' sustainable performance.

Therefore, it is evident that the concept of environmental innovation must be studied when determining the sustainable performance of the employees of any organization. As the research objective is to understand the antecedents of the high performance of the employees in the Cement Manufacturing industry in Sri Lanka, the concept of environmental innovation cannot be avoided.

5.5.4. The Mediating impact of Environment Innovation on the Relationship between Green Value Creation and Sustainable Performance.

Table 5.4 summarized the Research Question and Research objective to understand the mediating impact of Environment Innovation between Green Value Creation and Sustainable Performance in Sri Lankan Cement Manufacturing Industry. This is supported by the hypothesis and concludes summary of previous studies to support the findings obtained for this Construct.

Table 5.4 Mediating impact of Environment Innovation between Green Value Creation and Sustainable Performance

Research Question	Research Objective	Findings
How does Environment Innovation mediate the impact of Green Value Creation on Sustainable Performance?	To investigate the mediation of Environment Innovation on the relationship between Green Value Creation and Sustainable Performance	H4- Supported by data Partially mediate

(Source: Developed by the researcher)

The study found a partial mediating effect from environmental innovation. Green value creation drives environmental innovation. In contrast, environmental innovation is one of the main components influencing positive, sustainable performance.

Based on the review of the readings investigating the relationship between green value creation and firm performance, Molina-Azorín et al. (2009) propose that this relationship might not be direct. They advise future studies to address possible mediating variables. It is endorsed in the reviews of Orlitzky et al. (2003) and Blanco et al. (2009). From the viewpoint of the resource-based view (Barney, 1991; Wernerfelt, 1984), López-Gamero et al. (2009) and Orlitzky et al. (2003) advocate that environmental value creation results in the development of strategic resources that assist in achieving performance improvements. Numerous studies on the factors that affect the relationship between Green value creation and firm performance recognized innovation as a significant factor (Boons and Wagner, 2009; Christmann, 2000; McWilliams and Siegel, 2000).

For example, Rennings et al. (2006) propose that the presence of certified environmental management systems (EMAS) stimulates environmental process innovation, resulting in cost savings. Consequently, we consider ecological innovation as one of the strategic resources created due to conservational management's functioning and can improve firm performance. Entertaining these opinions and the developments, we can hypothesize that environmental innovation mediates the relationships between ecological value creation and robust performance.

Many studies investigating environmental management and firm performance have presented the relationships among sustainability's economic and environmental pillars (Ambec and Lanoie, 2008; Berchicci and King2007; Blanco et al., 2009; Molina-Azorín et al., 2009). The environmental innovations started by firms stand for the introduction of a more environmentally friendly arrangement of the firm's internal processes (using heat and water recycling technologies). Environmental product innovation is the introduction of an ecologically improved or a new environmentally friendly product (products or packaging that are easier to recycle). Exploring the mediating role of environmental innovation towards the firm's performance is empirically supported.

Environment innovations could improve the strategic results expected through the green value process. Overall, this evaluation offers a rationale to study the environment innovation as a mediating mechanism whilst its direct relationships with firm sustainable performances, and green-friendly functions proved empirically reinforced (Boons and Wagner, 2009; Christmann, 2000; McWilliams and Siegel, 2000).

Empirical arguments are there to justify environmental innovations that mediate when firms initiate environment management activities aiming for sustainable results or performances. Environment management functions and the firm's performances look like indirectly confirmed relationships. In contrast, a firm's degree of environmental innovations enhances it (Molina-Azorín et al., 2009). Studies argue and propose to examine the mediating role of environmental innovations when firms implement strategies with an environmentally friendly value process to achieve competitive performances (Boons and Wagner, 2009; Christmann, 2000).

5.6. Implications of the Study

5.6.1. Theoretical Implication

This study contributes to developing green value chain theory by examining the relationships between green value chain practices and corporate sustainability performances. That environmental innovation and not environmental management enables firms to improve their performance. Environmental management stimulates a specific type of environmental innovation, namely internally-oriented environmental process innovation, which can bring the firm only a cost efficiency advantage. The firms should develop environmental product

innovation after discovering the differentiation advantage. The latter requires the engagement of external parties (supply chain partners) rather than the operational internal environmental management. Consequently, studies in the "whether it pays to be green" debate should develop more situations for the relationship between different types of environmental innovation and firm performance advantages.

This paper contributes to the literature in three ways. First, improve a theoretical model that connects Green Value creation and Sustainable Performance outcomes with environmental innovation. Second, this contributes to the "whether it pays to be green" debate by exploring the mediating role of environmental innovation in the relationship between environmental value creation and Sustainable performance. Third, the paper supplements the research on the elements of environmental innovation by seeing the comparative roles of green value creation.

The initial theory of value chain Shih (2007) clarifies the integration of primary and secondary activities whilst each activity group is segmented (Porter, 1985). However, the study found that practical matters exist with the initial value chain model stated by Porter (1985) as cited in Shin (2007), as the organizations refine or revitalize their business process-related activities in line with sustainable submissions. This research address business process-related activities.

In terms of the knowledge impact, modifying classical values chain principles has a broad implication for similar industries worldwide that contribute to high carbon dioxide emission rates. These industries that currently practice the classic value chain Shih (2007) theory need to re-evaluate their business philosophies to adopt the proposed modifications to achieve sustainability.

Therefore, the theoretical implication differs from the practice patterns of green value chain activities in the modern business era. Manufacturing sector firms have to apply some country or industry-specific environmental methods. Such practices and the generic value chain activities measured with the accepted model find deviations highlighting theatrical gaps and arguments.

5.6.2. Managerial Implication

These results provide significant managerial implications. They reconfirm the relationships between Green value creation, environment innovation and Sustainable performance.

Accordingly, based on the managerial implication, it can identify critical concerns of existing stakeholders that the organizations need to address to be sustainable in the future. The research addresses serious emissions, raw materials, and process management. It is a benefit that cement manufacturers worldwide are focusing on adapting sustainable manufacturing through green values and principles.

In addition, many management theories have started to consider green sustainability as a critical area of study and implementation for organizations that have operations or practices in that country due to pollution. It can state that in organizations that work in competitive markets, the managers' attention has been on the profitability and the applicability of the organizational strategies and actions. The cost of activities (Environment Innovation) in terms of practicality equals the profits increased from the activities; examining the effectiveness of the practices is of great importance.

This study can assist managers of the Cement Industry organizations with a perspective on environmental innovation. Also, the possibility of these activities before taking action and assume the most feasible and profitable activities in terms of being environmentally friendly and economically practical. The association with suppliers can directly affect environment innovation practices and sustainable performance.

Managers need to conduct a cost-benefit analysis correctly. This research results show that, especially with green value creation and innovation, businesses can obtain some economic benefits.

The paper also delivers a managerial contribution as it discovers green values and environmental innovation performance implications. These results can assist managers in making decisions regarding implementing environmental value creation, environmental innovations and association with external parties. These findings will test if environmental value creation is a managerial tool to induce environmental innovation to improve environmental and economic sustainability. These study findings analyze the responsiveness of managers and supervisors towards the value creation models of cement manufacturing and selling companies in Sri Lanka.

5.6.3. Practical Implication

This study offers practical implications for both practitioners in the manufacturing context and policymakers. Most manufacturers' priorities in developing countries such as Sri Lanka are to expand their economic situation and avoid economic risks. However, Hart (1995) argued that it is not probable for businesses that pursue short-term profits to be successful in the long run by ignoring the environment. This study reports the significance of acting with a win-win principle where profit objectives edge with profit maximization and social benefits. Moreover, with this study, managers can obtain information about the comparative benefits of each green practice.

Environmental innovation can provide firms with advantages for their performance. The study shows that environmental innovation in the green supply chain is required to develop environmental product and process innovation and improve the company's performance through these innovations.

The study emphasizes the practical significance of the research and contests the drawbacks of the capability of classic value chain theory. This study also addresses the new dynamics of stakeholder expectations in today's business context, which require organizations to be more responsible in manufacturing than merely generating a profit margin. The research identifies that stakeholder expectations are represented more accurately through green value chain concepts, which indicates the need to modify the classic value chain Shih (2007) model.

Environmental innovation through reducing environmental impact can improve the economic pillar of sustainability. The latter can mitigate problems related to the double outwardness of eco-innovation and corporate underinvestment in eco-innovation. (Rennings, 2000). Firms that capitalize on environmental innovation benefit public authorities because they affect external costs. This study could be a promising direction for future policy development because public authorities can stimulate environmental innovation. It can be supposed that policy intervention to alter the role and influence of public authorities or intermediaries could promote environmental innovation among the companies. Industry practitioners could make suitable measures to incorporate human resources and innovative value creation strategies to meet suitable business performances.

5.7. Conclusion and Recommendations

5.7.1. Conclusion

Green value creation has a positive and significant effect on sustainable performance in Cement Manufacturing Industry in Sri Lanka.

The findings of this study could be justified mainly for the Cement Industry. In the wake of literature concerning green value creation, there is much experimental research on the connection between understanding environmental innovation and sustainable performance. It finished with a research gap inside the exploration field. This population to diminish this research gap and acquire more information about the relationship.

In this study, the researcher attempted to fill the literature gap to analyze the relationship between three essentials: green value creation, green innovation, and sustainable performance. The results demonstrated the relationship between the three variables.

The examination gives exact proof that green value creation positively affects sustainable performance. One of the essential achievement factors for benefit associations today is to benefit employees through environmental innovation. An additional argument was empirically supported to claim the mediating influence of environmental innovation that makes a combined effect with green value creation on sustainable performance. Environment innovation has a partial relationship with green value creation and sustainable performance. The researcher justified the empirical gaps in industrial markets in evaluating sustainable performance.

The analysis of the demographic factor makes it reasonable to assume that most employees are middle-level, having degree-level experience and practical experience within the industry.

5.7.2. Recommendations

5.7.2.1 Implementing Green supply chain and green energy in HOLCIM

Holcim Lanka adopted a new strategic direction to manufacture and promote more blended or application-based cement in the future. The premise is that this direction will be inevitable in less than ten years. This strategic direction will help develop emerging markets as

environmental pollution becomes a significant concern with launching more projects and the demand for cement increases**.** (Nia, 2017).

The local governments will increase pressure in these markets for cement manufacturers to be more environmentally responsible, and the direction of the industry will gradually shift towards using blended cement. The organization sees the new strategy as a *first into the market*, giving them a competitive advantage over competitors when the direction moves more towards blended products. The new strategic direction will not deviate from corporate mission parameters by promoting more application-based cement. However, it will reinforce the statement of *providing value to all stakeholders* by taking a more environmentally responsible route. The cement industry produces nearly 4.3 billion tons of cement, for which 4.1 billion tons of clinker each year, according to the U.S. Geological Survey (2011 P38 -39). The estimated amount is a predicted rate of 7% to 8% each year to cater to the increasing demand for this product. The primary process in cement manufacturing consists of quarrying, crushing, clinker manufacturing and cement milling. (Nisa, 2017).

Pre-heating the Kiln feed involves high energy consumption, primarily in non-renewable energy functioning through electricity. The cement industry contributed to approximately 5% of global energy consumption and nearly 7% of the total CO2 emissions to the world energy council in 2014. The greenhouse gas effect, which causes increased temperature by reducing the thickness of the ozone layer due to carbon dioxide proliferating into the atmosphere, is of primary concern to many stakeholders closely associated with businesses with high carbon dioxide emissions. Industries such as vehicle manufacturing, drilling for crude oil, steamship lines, the airline industry and even cement manufacturing have all been targeted by heavy legislation over the past few years, identifying these industries as one of the largest contributors to carbon dioxide emissions (Rommel et al., 2008). In cement producing chiefly solid waste embody clinker production and spoil rocks, that area unit is far away from the raw materials throughout the meal preparation. In addition, oven mud and ash from the station throw in solid waste. Alternative waste comes from plant maintenance, like used oil and metal scrap. Principally these wastes are area units disposed of by lowland outside that cause many respiratory organs and inhale drawbacks. Currently, most of the plant's mistreatment ash for cement production Cement Data Book (2017). Lime waste from the crushing department generates in clinker production or sulfate treatment once re-crushing. Typically, in-depth

mining activities bite the water level and should contaminate spring water. Deposit of mud in open space causes land degradation and deposits over plant leaves. The cement industry generally uses coal, heavy furnace oil, petroleum coke and natural gas in producing heat for combustion. Traditional fuel uses in the combustion process in the cement kilns. Due to high operating temperatures and residence times, the cement kilns have the required characteristics and conditions to use alternative fuels derived out of waste, including organic and hazardous waste, effectively to produce heat without detrimental impacts on the environment, causing harmful emissions.

This technology is co-processing in cement kilns. Co-processing is classified as two processes coinciding. While clinker is produced in the cement kiln by calcination, thermal destruction of the waste (coming via waste-derived fuels) takes place simultaneously in the cement kiln. Almost 61% of global CO2 emissions are generated by industrial activities (electricity and heat generation and other industries), showing the significant impact of such processes on climate change. Although there is an urgent request for energy and emission reduction in global, global industrial GHGs emissions (CO2) are rapidly increasing by 2030. This emission is mostly due to combusting huge quantities of carbon-intensive fossil fuels to generate the necessary power. In addition, some industrial processes have reactions which chemically change raw materials to waste gasses such as CO2. Draft Inventory of U.S., 2011 has shown the list of such processes. Considering the USA is the second largest carbon producer country, in 2009, three major emitting industrial productions were steel and iron and cement production. OPC is a vital construction material and strategic commodity (Vlasopoulos, 2010). Such is our dependence on OPC that the world currently produces nearly 3.6 billion metric tons of the material each year (USGS Mineral Commodities Summary, 2012), with volume predicted to rise to more than 5 billion metric tons by 2030 (Muller and Harnisch, 2008; OECD/IEA and World Business Council for Sustainable Development, 2009). Although figures vary from country to country, around half of the world's OPC makes around 11 billion metric tonnes of concrete, while the other half utilizes mortars, screeds, stucco, coatings, soil stabilization and other applications. (New Zealand Cement Holdings, 1988; Smith et al., 2002). Today, the main leader of the OPC market is China, where there is 57.3% of global consumption (CEMBUREAU, 2012). Like the rest of the construction industry, the cement industry is facing unprecedented challenges relating to energy resources, CO2 emissions and alternative materials. Worldwide, the cost of energy is rising inexorably as fuel sources deplete. This fact has clear, traceable impacts on the

cost of producing cement and its market price; Green taxes are an additional cost that will include, if emissions are not restricted, potentially leading to a doubling in the price of cement by 2030 (OECD/IEA and World Business Council for Sustainable Development, 2009). Despite the incremental improvements in process efficiency adopted by the cement industry in recent years, OPC production is still responsible for around 6% of all artificial global carbon emissions.

The Cement Sustainability Initiative, developed by the World Business Council for Sustainable Development, brings together the major cement producers worldwide to try and tackle this problem (OECD/IEA and World Business Council for Sustainable Development, 2009). One study from Australia, conducted by Simpson et al., explored the moderating impact of relationship conditions between a customer and its suppliers and the effectiveness of the customer's environmental performance requirements (otherwise known as "green supply"). Practically no research exists on the effectiveness of green supply requirements when placed in context with the realities of inter-organizational dynamics. The International Energy Agency recently proposed a global CO2 reduction plan. This plan has three main elements: long-term CO2 targets, a sectoral approach based on the lowest cost to society, and technology roadmaps demonstrating the means to achieve CO2 reductions. This plan proposes to reduce CO2 emissions from 2Gt in 2007 to 1.55Gt in 2050, while cement production will continuously increase by about 50%. The authors of the cement industry roadmap point out that the extrapolation of existing technologies (fuel efficiency, alternative fuels and biomass, and clinker substitution) will only take us half the way towards these goals. According to the roadmap, the industry will rely on costly and unproven carbon capture and storage technologies for the other half of the required reduction.

This adaptation will result in high additional costs for society. Most of the CO2 footprint of cement is due to the decarbonization of limestone during the unnatural process. Designing new clinkers that require less limestone is one way to reduce the CO2 footprint of cement and concrete significantly. A new class of clinkers now under development can reduce CO2 emissions by 20 to 30% compared to traditional Portland cement clinker manufacturing. (Nisa, 2017).

Currently, most plants conduct mistreatment ash for cement production. The mud collected from different pollution-dominant devices was used twice in the producing method. In cement industries, water is employed just for the cooling operation of the producing method. Integrating environmental management practices into the whole supply chain management is vital to achieving a greener supply chain, maintaining competitive advantage, and increasing business profit and market share objectives. Various definitions of green value chains exist in the literature. Zhu and Sarkis (2019) stated that e green value chain has ranged from green purchasing to integrated supply chains starting from supplier, to manufacturer, to customer and reverse logistics, which is "closing the loop". According to Srivastava, *a green value chain* defines as "integrating environmental thinking into supply chain management, including product design, material sourcing and selection, manufacturing process, delivery of the final product to the consumers as well as end-of-life management of the product after its useful life". The quality revolution of the 1980s and the supply chain revolution of the 1990s extended the green supply chain literature with the beginning of corporate environmental management, environmentally conscious manufacturing strategy, and supply chain management literature.

It has become clear that the best practices call for integrating environmental management with ongoing operations. Green supply-chain management (green value chain) is gaining increasing Zhu and Sarkis (2019) interest among researchers and practitioners of operations and supply chain management. There are many studies regarding green value chain Adaptation and implementation in developed countries. Still, limited studies have examined developing countries' green value chain practices. With the current direction of the global market and the increased pressure, cement manufacturers will have to use cleaner, sustainable manufacturing methods.

5.7.2.2 Implementing KLIN management process in cement industry

The cement kiln requires a uniform quality fuel mix to have stability in the combustion process in the kiln. Using waste-derived fuel imposes the challenge on the process engineers and production managers to supply a homogeneous fuel mix derived from different waste types with varying quality. To face this challenge and to ensure environmental and regulatory compliance in co-processing, it is critical for the cement companies carrying this activity to have a dedicated unit to perform the below two prominent roles. Rommel et al., 2008). One is

to provide waste management solutions by operating at the front end to secure waste sources to be directed to the cement kiln and provide a service to the waste generators by providing a solution to the waste. This part of the organization operates as a service organization in the waste management/ environmental industry, focusing on the needs and wants of the waste generator. Two is to provide an alternative fuel to the cement kilns by preparing a waste-derived fuel, which can be substituted in the cement kilns as an alternative fuel and supply a constant quality alternative fuel source to the cement kilns. It is required to maintain facilities to pre-process waste to bring them to a homogenous quality and to work closely with the cement plant to supply a fuel mix meeting their specifications (Rommel et al., 2008).

Some operations could also generate waste material with high pH and suspended solids. Usually, the water used for cooling purposes can be recycled and reused within the system. Screening for suspended solid reduction has been completed by mistreatment subsiding basin and clarifier. Water treated from wastewater treatment plants should utilize for inexperienced belt development. This inexperienced belt conjointly helps in minimizing sound pollution. At lime mining sites and cement plants, contaminated streams of rainwater should be directed to the wastewater treatment plant used for the process. Azevedo et al. (2017) stated that stormwater flowing through pet– coke, coal, and waste matter stockpiles exposed to the out-of-doors might become contaminated. Rainwater ought to be shielded from contact from coal depot clinker and lime and ash enclosure to forestall contamination by covering the enclosure and may collect at some tank for further use in a mud suppression system at the plant. If stormwater contacts the storage yard, it should indicate the presence of high sulfate in soil and cyanogenic metals like atomic number 30, Lead and Cr within the mud and high TDS value in water. The addition of industrial outgrowth and wastes to cement in the production process or to concrete mixtures essentially improves the manufacturing process's overall energy balance and efficiency.

Azevedo et al. (2017) stated that it is not the only way energy efficiency can be improved. Over the decades, the cement production process has changed from using a slurry process to mix the raw meal integrant to a dehydrated process in contemporary plants. Furthermore, the addition of preheaters to the older, long kilns has enlarged heat recovery and caused an increase in production quantity, leading to a decrease in the energy enforced for cement production that has significantly contributed to cement’s sustainability production. Even now, up to 6 preheaters and a pre-claimer are considered standard equipment in a modern cement plant.

Another modern advancement in improving energy efficiency is the practice of heat recovery to bring out electricity. Azevedo et al. (2017) stated that traditionally the manufacturing methods use the draining heat from cement kilns to dry coal or raw materials, but since the 1980's different boiler and heat exchanger mergers have been installed at cement plants worldwide to generate steam and afterwards electricity from it. Of course, this concept comes off at the back end of the manufacturing process. Some companies keep advertising on the internet and claim that up to 30% of the accumulation can be achieved in the electricity expenditure of a cement plant if waste heat recovery systems are available to develop on-site electricity. The knowledge manager contributes the solutions and advanced tools necessary to facilitate the collection, organization, and circulation of combined production, quality, and energy information throughout a plant organization through web-based articles, trends, and graphs.

The web page depicted all relevant key performance indexes for the process. If an operator wants to enlarge production and, at the same time, maximize the usage of alternative fuels, the Knowledge Manager provides the information for appropriate analysis to establish what is and is not possible. Azevedo et al. (2017) KM can be adapted and developed to meet each company's specific requirements. It simplifies cement production management by covering processing-related functions such as reporting, processing operations checking and reporting, Material storage management, and energy and emission reporting. With KM and Production tracking, analyzing process criterion's influences on production capacity, product quality, energy consumption, and emission levels is now simpler than ever. It uses energy indexes, production-related data, process variability, and run-time quality parameters to produce comprehensive operation trends and production reports. The trends result and quality of reports in the superior utilization of equipment, inventories, energy, and capacities (Kalhara, 2018).

5.7.2.3 Adaptation of green process in HOLCIM LTD

Testing and pre-qualification. The candidate waste sample needs to undergo testing and pre-qualification. A technical feasibility analysis: - executes before accepting a waste, assessing the possible combustion products and preprocessing required for the bulk waste load. The cement plant sets the waste's acceptance specifications following pre-qualification analysis. B) Permitting and approval Environmental approval: - The relevant authorities require collecting, transporting, storing, and treating waste. The approval needs to be sought jointly by the waste generator and the treatment facility and given with conditions where both parties have to

comply. c) Commercial terms and agreement Kalhara (2018) stated that the waste generator and the relevant treatment facility need to agree on the commercial terms and conditions for treatment and disposal before the physical movement of the waste happens. As hazardous waste is subject to stringent regulatory criteria, typically, an agreement is signed between the parties prior to shipping the hazardous waste with specific details about the transfer of the ownership of waste. d) Testing and fingerprint analysis:- The companies conduct this step before transferring the waste or before acceptance at the treatment facility. The employees check a sample of waste, the bulk waste load, to identify whether the waste characteristics fall within the pre-agreed criteria. e) Collection:- The workers prepare the waste load for transportation, which may include packing, repacking, transferring to safe containment in the case of liquid waste, covering and sealing. Labelling is particularly required if hazardous waste is available. f) Storage The waste may have intermediate storage under appropriate conditions specified. g) Preprocessing involves preparing the waste material to be fed and used as a waste-derived alternative fuel based on the specifications required by the cement plant. For solid wastes such as textiles and polythene, shredding into small pieces may be required. For hazardous wastes, chemical treatment such as neutralization, decontamination of containers, mixing and dilution. h) Transportation: - at this stage, the workers transport the waste to the treatment facility. I) Handling, storage and conveyance. It is significant to store and convey the waste. The waste should transfer to the cement kilns via the appropriate feeding mechanism. Some wastes have dedicated feeding lines. j) Co-processing:- the waste is destroyed to maintain under controlled conditions. k) Compliance monitoring. The workers monitor the gasses of the combustion process and continue to ensure that the emissions are within the permissible limits set for the cement manufacturing process (Kalhara, 2018).

Developed countries consider a high-level development of countries based on specific characteristics, namely economic, industrialization and Human Development Index (HDI). The economic characteristic is the income per capita. Countries with high income or gross domestic product per capita define as developed countries. Then, according to industrialization characteristics, developed countries are the tertiary and quaternary sectors of industry. Another recent measure, the Human Development Index (HDI-2019), integrates an economic measure, country income, with indices for expectancy and education. *Developed countries* define this characteristic as those with a higher HDI rating. Thus, developed countries deal with many environmental issues and depletion problems due to their increasing economic development.

Most researchers conducted their study in developed countries to examine the integration of environmental concepts and supply chain management. One study from Germany conducted by Large and Thomsen identified five potential drivers of green supply chain management performance:

- green supply management capabilities
- the strategic level of the purchasing department
- the level of environmental commitment
- the degree of green supplier assessment
- the degree of green collaboration with suppliers

Azevedo et al. (2017) examined the links between green practices of supply chain management and supply chain performance in the Portuguese automotive supply chain context. This study obtained the conceptual model from data analysis that provides evidence that green practices positively affect quality, customer satisfaction and efficiency and adverse effects on supply chain performance in the study of Chiou et al. (2018). Using Structural Equation Modelling, Taiwan has explored the correlation between greening the supplier and green innovation in the Taiwan industry. They concluded that greening the supplier through green innovation significantly benefits the firm's environmental performance and competitive advantage.

5.7.2.4 Implementing Global reporting initiative

Holcim has been a pioneer in identifying and developing the concept, technology and know-how on co-processing in the cement industry over the last three decades. In 2008, all intermediary business units and companies carrying out co-processing and operating in the waste management industry as a common identity, Geocycle, across the group. Holcim has more than 30 service-oriented business units/ companies across the group (Chiou et al., 2018).

The researcher examined the GSCP adopted by Third Party Logistics (3PLs) service providers, such as specific practices implemented and the level of Adaptation of each practice and also examined the relationship between various GSCP implementation and company performance in a study in Italy conducted by Cagno et al. (2014). In this study, the work offers a deep understanding of the potential effects of GSCP on company performance. The study from Japan conducted by Ardmore et al. determined the influence of ISO 14001 certification on green supply chain management (green value chain) by using Japanese facility-level data. The study proved that ISO 14001 and voluntary EMS government programs significantly influence green

value chain practices. These programs highly perhaps the facilities will evaluate their suppliers' environmental performance and ask suppliers to undertake specific environmental practices. Another study from Japan by Zhu et al. (2019) aimed to introduce large Japanese manufacturers' environmental, green supply chain management experiences. This work shows that large companies can green their supply chain by creating win-win relationships with their partners, realizing sustainable growth for the entire supply chain. Besides, it also indicates that relevant regulations and policies set by the government can help green value chain circulation from larger leading companies to smaller companies. Hsu and Hu investigated the consistency approaches by factor analysis that determines the Adaptation and implementation of the green value chain in the Taiwanese electronic industry. The fuzzy analytic hierarchy process method was applied to prioritize the relative importance of four dimensions and 20 approaches among nine firms in the electronic industry.

Meanwhile, Shang et al. Explored key green supply chain management (green value chain) capability dimensions and firm performance based on electronics-related manufacturing firms in Taiwan. Based on a factor analysis, the study identified six green supply chain management dimensions: green manufacturing and packaging, environmental participation, green marketing, green suppliers, green stock, and green eco-design. Holt and Ghobadian investigated the level and nature of greening the supply chain in the UK manufacturing sector. This study explores the driving forces behind the environment, the specific management practices that result, and the relationship between them. The study by Nawrocka et al. (2016) In Sweden has concentrated on the role of ISO 14001 in environmental supply management practices in Swedish companies. The study described the current and potential role of ISO 14001 for three critical operational tasks of environmental supply chain management: to communicate the requirements to the supplier, to motivate and enable the supplier, and to verify that the supplier follows the requirements.

Moreover, the study from South Korea carried out by Lee has identified the drivers of participation in green supply chain initiatives by considering small and medium-sized suppliers and their most important stakeholders, including buyers and the government. Raymond et al. (2014) examined the relationship between supply chains and the environmental performance of SMEs in Canada. This study proved that the most limiting factors are the time and financial resources to deal with solid waste and energy issues. In addition, Chen looked into the relationship between green innovation and the green image of companies in Taiwan. The study

proposed a new concept of green core competence. Chien and Shih (2019) examined the Adaptation of green value chain practices in Taiwan's electrical and electronic industry. These researchers studied the relationship between green supply chain management practices, environmental performance, and financial performance.

5.7.2.5 Implementing manufacturing Sustainability model

Holcim (Lanka) Ltd. is a wholly-owned subsidiary of Holcim Ltd., Switzerland, which has a presence in over 80 countries worldwide. Holcim (Lanka) Ltd. produces 1.3 million MT of cement and approximately 640,000 MT of clinker annually. It has Sri Lanka's only fully integrated cement plants with two rotary dry kilns, each with 1100 MT/day capacity in Puttalam and a grinding station in Galle. Sri Lanka's annual demand for cement sold is about 5.9 million MT, and Holcim Lanka is a leading player in the cement market in Sri Lanka, with approximately 38% market share. Holcim Group set up a dedicated unit to carry out co-processing activities, with a separate identity called Geocycle, worldwide. In Holcim (Lanka) Ltd., Geocycle functions as a Strategic Business Unit (SBU) under the same legal entity as its waste management arm. Holcim (Lanka) Ltd. operates Sri Lanka's only fully integrated cement plant, which consists of two dry kilns with four-stage suspension pre-heaters, located in Pahlavi, Puttalam. Each kiln has a capacity of 1100 MT/ day. The kilns operate as rotary, counter current plug flow reactors and have operating temperatures between 900 C and 1450 C at the material entry and exit ends.

When the UN published its first sustainability report in the late 1980s, its paper indicated a paradigm shift. Until then, each generation could be sure that their work and achievements would contribute to a better future for their offspring. Based on data collected for a global environmental report in the 1970s, it turned out that such a development could not be guaranteed any longer. Inconsiderate exploitation of natural resources and the growing impact of a rapidly increasing world population made the experts paint a rather dark picture for the future of humankind. Therefore, the attitude towards unlimited growth and expansion changed considerably. From that time onwards, the goal was to provide future generations with global conditions that ensure a lifestyle that is still livable. Meanwhile, international sustainability initiatives try to define how the economy can thrive without further compromising the environment and how companies should take on higher responsibility for the well-being of society.

During the last decade, politics, especially in the European Union, considerably tightened the legal frameworks for enterprises' environmental and social conduct. Especially the manufacturing industry, as the most energy and resource-consuming sector of the economy, is confronted with a growing number of restrictions and guidelines. Moreover, even though regulatory constraints regarding environmental issues are getting stricter and the European welfare state has relatively high social security standards, politics always lag behind the more fast-paced global developments. Genuine sustainability achieves if companies pledge themselves to the cause voluntarily, closing the gap between meeting basic legal requirements and thinking about long-term consequences. In this paper, an innovative sustainability framework called "Doughnut Economics" will be presented. This framework provides the basis for developing a model dedicated to manufacturing SMEs.

It will be essential to tailor to the specific needs of such companies, which due to their size and capacity restrictions, cannot afford the financial and personnel resources of multinational corporations specifically assigned to sustainability issues. In SMEs, pooling all ecological and social issues in one specialized department or staff function does not make sense. On the contrary, these issues have to be intricately interwoven into all internal and external processes, stakeholder interactions, the corporate culture and leadership style. Only then holding up to self-imposed standards can also become a decisive competitive edge. The origins of the sustainability concept go far back into the past. The Saxon forester Hans Carl von Markowitz (1645- 1714) already conveyed the concept of sustainability in the forest industry. Facing the threat of a raw material crisis, his work "Sylvicultura economical", dated 1713, explained for the first time that only as much wood lumbered can grow back by planned reforestation. Therefore, the principle of sustainability is supposed to ensure that a natural system can maintain its essential characteristics long-term. Based on this historical background, *sustainability* is "a resource economic principle, which allowed a resource to be used permanently profitable". A geopolitical discussion has begun regarding the problems of environmental pollution, the consequences of overpopulation and the ruthless exploitation of resources during the 20th century. The UN World Environment Conference in Stockholm in 1972 was a milestone and the beginning of international environmental policy.

In 1983 the United Nations set up the World Commission on Environment and Development (WCED) as an independent expert commission based in Geneva. Their mission was to give

their perspective regarding a stable and environmentally friendly global long-term development up to the year 2000 and beyond. In 1987 the so-called Brundtland Report with the title "Our Common Future" was published, which obtained its name from the Commission Chairman and former Prime Minister of Norway, Grow Harlem Brundtland (2014). We owe a frequently quoted definition of "sustainability" to this policy paper, which tries to unite various political interests by treating environmental objectives and economic and social development as equally important: "Sustainable development meets the needs of the present without compromising the ability of future generations to meet their own needs". This definition was too vague and thus allowed too much room for interpretation. There is no universal or generally accepted definition of the term. Instead, the respective definition of sustainability matches the context from which it originates. When interpreted from a political viewpoint, for example, it can be regarded as "stable, ecological and social structures that are crucial for the 'self-continuation potential' of the society". A definition attempt from the economic perspective by Iris Puff says: "Sustainability does not mean to generate profits, which then flow into environmental and social projects, but to already be profitable in an environmentally and socially responsible way". Therefore, it seems reasonable not to talk about a "term" but rather about a "concept", which according to the Dictionary of Sustainability, displays the following common aspects: Sustainability is always oriented towards the present and future and thus has a temporal reference. Resources, tangible/intangible assets, economic/ ecological units, Etc., are to be protected, especially if they are non-renewable.

A reference object's continued existence is ensured in short and the long term. In this context, it also seems interesting to note that - especially in colloquial speech - the keyword sustainability (or sustainable) is already conspicuous by its "inflationary use". This term means that state A can be more "sustainable" as a comparative state B. Some authors, however, see it as an absolute. Therefore, a state or a development can either be sustainable or not: "An important crucial property of sustainability is that the concept is an absolute, as are pregnant and unique, to use two common examples. A sustainable world is not slightly more environmentally responsible than yesterday." Instead of defining the term, sustainability models have become popular. Therefore, the study will discuss the most accepted in the subsequent sections. As is also the case in the corresponding literature, "sustainability" and "sustainable development" are subsequently used synonymously. A. Classic Models In this section, the most common traditional sustainability models and their evolution will be briefly

introduced, as described. Three Pillar Model: The Agenda, passed at the first United Nations Conference on Environment and Development in Rio de Janeiro in 1992, represents an action program for global sustainable development. As a result, the organizations adopted sustainability as the guiding principle of politics, based on the insight that global environmental protection is only possible if politics draws the same attention to economic and social aspects.

Therefore, the three basic dimensions of sustainability are ecology, economy and social affairs. In the 1990s, these three aspects were first related to each other in the sustainability triangle. The triangle has, however, not prevailed due to a lack of long-term significance. The Equate-Commission "Protection of people and the environment" established by the German Bundestag developed the "Three Pillar Model" in 1995. It points out the interdisciplinary character of sustainability. The three pillars are on an equal footing and equivalent to each other, forming "a three-dimensional perspective" for a sustainable social policy. Integrative Model: The Integrative sustainability model represents an evolution of the above described two classical concepts.

5.7.2.6 Implementing Geo cycling process in cement industry

These are discussed controversially as the extensive complexity of sustainability is insufficiently represented, for example, by the three separate pillars. Co-processing was started in Holcim Lanka's annual report in 2002. Rice husk and sawdust were the key alternative fuel used. There was a change in strategic direction to move from agricultural waste to industrial waste, especially hazardous waste, and a dedicated business unit was formed in 2004 to carry out co-processing. A detailed survey on waste generation was done, focusing especially on hazardous waste during the same year, and the first waste marketing plan was formulated to enter the hazardous waste market. In 2005, industrial waste co-processing started, and the first load of pharmaceutical waste was co-processed with the approval of the Provincial Environmental Authority (PEA) of the North Western Province (NWP) and the Central Environmental Authority (CEA). Geocycle also took steps to apply for a general permit to co-process waste by submitting a detailed project proposal to the PEA of NWP as a prescribed project. To win acceptance for co-processing among its focused stakeholders, Geocycle launched a long-term communications strategy, also in 2005. By 2006, the total industrial customer base consisted of 22. To gain generic permits for hazardous waste co-processing,

Geocycle started the Environmental Impact Assessment (EIA) study while continuing to provide solutions for non-hazardous waste and obtaining permits for hazardous wastes on a case-by-case basis. Taking another development in its strategy, in 2007, Geocycle started supplying total solutions to Colombo Dockyard PLC, a large-scale industrial waste generator, building up a partner network to handle wastes not diverted to co-processing. Geocycle adopted the global identity the same year and started operations of its first pre-processing facility in Peliyagoda. In October 2008, cement kilns operated by Holcim Lanka demonstrated their ability to thermally destroy a hazardous waste to a Thermal Destruction Efficiency (TDE) exceeding 99.9999%, considered an acceptable global standard. The Environment Authorities of Sri Lanka assessed and monitored the kilns' TDE using Poly Chloro Biphenyl (PCB) wastes. In 2008, Geocycle obtained the first Environmental Protection License (EPL) for hazardous waste co-processing in cement kilns to a list of wastes, enabling it to accept a large range of hazardous waste. It also expanded its operations to provide a solution to the waste of 84 companies in the Katunayake Export Processing Zone (KEPZ) and signed a contract with the BOI. Expanding its capacity, Geocycle constructed and opened for operations the first fully-fledged pre-processing plant to process hazardous waste in the KEPZ. By 2010 the total customer base consisted of 194, and Geocycle was able to co-process more than 40,000 MT of waste. Also, the countless interactions between ecological, economic and social realities and developments are not comprehensively covered. Therefore, the understanding of the term has evolved: Nowadays, sustainability represents an integrated way. Three overlapping circles form an intersection in the middle representing sustainability, thereby emphasizing the mutual relations and interdependencies of the three aspects. German Federal Environment Ministry, the Centre for Sustainability Management (CSM) at the University of Luneburg and Eco sense, the Forum for Sustainable Development of the Federation of German Industries (BDI), designed the model through a series of studies. Also, the University of Karlsruhe has been instrumental in developing this approach. Triple Bottom Line Model: While the previous models – especially known in Europe – mainly have a political and environmental background, the well-known Triple Bottom Line (TBL) model was developed using Anglo-American culture from an economic vantage point. The "Three P's" (People, Planet and Profit) are the basis of this accounting concept. The concept was presented to the general public by John Ellington, an American author and opinion leader in sustainable economic development. The term "bottom line" refers to the English expression for the final line of a balance sheet. Below the bottom line, whether a company has generated either profit or loss in the previous fiscal

period can be seen. According to Ellington, the objective of sustainable enterprises is to be financially profitable and display positive results regarding environmental protection and social justice equally. The companies expect to provide some overall full cost accounting and solely economic considerations of their general activity. Thereby also, direct and indirect costs caused by effects on the environment and society need to be assessed. The TBL model sees the responsibility of enterprises not only towards their shareholders by maximizing their profits but towards all stakeholders by balancing their interests. A stakeholder in an organization is (by definition) any group or individual who can affect or is affected by the achievement of the organization's objectives.

5.7.2.7 Diverting Waste to a Sustainable End Destination for CEMENT industry Sri Lanka

The main environmental benefit in the case of Sri Lanka by co-processing is making the services of the cement kilns available to provide a final destination for industrial waste, especially hazardous waste, which would have otherwise caused significant environmental problems over its life cycle. Green supply chain practice represents the environmentally-friendly image of products, processes, systems and technologies and the business operating. Nonetheless, as stressed by Anbumozhi and Kanda, most companies, especially in developing countries, adopt green solutions to their business to reduce the negative environmental effects rather than adopting a proactive approach to reduce the sources of waste or pollution. Then, these adopted green solutions continue to be the traditional command-and-control or "end-of-the-pipe" solutions. Therefore, there is a need to put more interest in studying the Adaptation and implementation of the green value chain in developing countries due to the "end-of-the-pipe" approach. Only limited studies are available on the concern of green value chains in developing countries, especially in Asian Regions. The green value chain concept is relatively new in the South East Asian Region, and probably only a few companies can implement it. However, as claimed Rao, his study on the green supply chain in the South East Asian Region (Philippines, Indonesia, Malaysia, Thailand, and Singapore) found that environmental supply chain practices had started to take place. Thus, the research findings in Asian Region can be useful for manufacturing in developing countries to develop the appropriate green value chain practices and help reduce environmental problems. Recent literature showed that most researchers are starting to investigate the green value chain in the East Asian Region, especially

China as a developing country. The issues related to the green value chain have become even more critical in China. Although China gains more opportunities as a major manufacturing country, they also deal with huge environmental problems with this opportunity. Zhu et al. Investigated whether different Chinese manufacturer clusters varying in their extent of implementing green value chains exist from the ecological modernization perspective. In Sri Lanka generation of hazardous waste was estimated to be about 66,000 MT in 2006, out of which a large percentage can be co-processed in cement kilns as identified in the Environmental Impact Assessment for the proposed co-processing of schedules wastes in the kiln of cement plant at Holcim Cement Works –Puttalam. Hazardous waste material is defined based on its constituents under the "Guidelines for the implementation of hazardous waste management regulations of Sri Lanka" (GIHWMR) published by the Central Environmental Authority of Sri Lanka. The Higher recognizes co-processing in cement kilns as a solution to treat hazardous waste in Sri Lanka. As per the Giver, the generator needs to identify hazardous waste generated at the point of generation. Proper segregation is significant to avoid mixing hazardous waste with non-hazardous waste, as the slightest contamination makes the non-hazardous waste stream also hazardous, requiring stringently regulated disposal. Geocycle has been able to establish best practices in managing hazardous waste contributing to environmental as well as social sustainability. Holcim Lanka obtained approval from the PEA of NWP to use the cement kilns operated by the Putnam Cement Plant as a hazardous waste co-processing facility under environmental monitoring by the PEA of NWP. An approval covers collection, storage, transportation and pre-processing operations by the PEA of NWP and the CEA. The table highlights the incremental impact on the environment by adopting a more sustainable solution for waste management as per the waste management hierarchy. The study also examined whether Chinese manufacturers' awareness of local and international environmental ESPR-oriented (enhancing energy savings and pollution reduction) compliance is related to green value chain implementation and whether or not a mediating effect of regulatory pressure plays a major role. Then, a study found the varying pace of Chinese manufacturers to ecological modernize with green value chain practices and the significance of regulatory pressure to distribute the practices. The study by Liu et al. China has analyzed the relationship between green supply chain management level (green value chain) and the classified determinant factors. The study confirmed that a company's environmental management capacities enhance by frequent internal training of employees to increase its involvement in green value chain practices. Another research from China, studied by Yan Li,

examined the Adaptation levels of green value chain practices in China and explored the performance measurement for the green value chain. The findings demonstrated that the green value chain was strongly balanced with other advanced management practices and contributed to improving environmental performance. Zhu et al. evaluated green value chain practices relating to green value chain to closing the supply chain loop for four Chinese industries (power generating, chemical/petroleum, electrical/electronic and automobile). They concluded that the Adaptation of green value chain practices in different industrial contexts is not uniform across the four industries. Another study also by Zhu et al. in China has evaluated and explained green value chain drivers, practices and performance among diverse Chinese manufacturing firms. Other than the traditional models, newer models either use a much more systemic view or additional sustainability dimensions to describe the complexity of problems. A very innovative approach is the dynamic model of the so-called "Doughnut Economics", developed by the researcher Kate Haworth in collaboration with the Oxfam initiative. Systemic Approach: Complex systems like our biosphere rarely react according to a linear cause-effect principle. Solving problems using a systemic approach assumes that a problem cannot be isolated but that the whole system and its interactions and interdependencies always need to be included. A systemic view of the sustainability issue has emerged for evaluating the effects of human/environment interaction and for developing long-term forecasts and models that are as realistic as possible, serving as an action and decision framework. In his review article, the American researcher Jiangsu Liu summarized such innovative approaches. Among the most important issues that require a systemic approach are, for example, air pollution, loss of biodiversity, the assurance of food and energy supply, the spread of diseases and the scarcity of water. These issues are often explored and addressed separately; however, they are interconnected via the three dimensions: On an organizational level and in space and time. Various integrated frameworks have been used in recent years to investigate and quantify these effects. These include environmental footprints, human nature nexus, planetary boundaries and tail coupling (investigating socio-economic- and environmental effects over spatial distances). Typical examples of systemic effects in this context are changes in land use and CO2 emissions caused by biofuel production. This example shows the increasing demand of the western industrial nations for "environmentally friendly biofuel", which, however, on the other side, goes hand in hand with the illegal deforestation of tropical rain forests for oil palm cultivation, especially in Brazil and Indonesia, as well as increases in global food prices for maize and rapeseed. Systemic approaches aim to investigate and evaluate the long-term so-called

"cascade" and "spillover" effects, which describe implications for a system not by direct but by systemic interactions. Fourth Dimension Approach: If sustainable development is understood as a process-oriented approach with a normative and ethical basis, then far more than the previously discussed three classic dimensions, "social, ecological and economic", need to be included. Second-order concerns must be considered. They are relevant for all three original dimensions to the same extent in a separate fourth dimension by Securer. The authors identified the following second-order issues:

5.7.2.8 Implementing Cement Green Merchandising Model

Sustainability is an eidolon that has been affected by many sectors. It is related to the different societal dimension which directly or indirectly affects environmental degradation and social and economic dimension. Sustainability has become a common concern for all industrial sectors. Cement kiln co-processing is economically feasible, and the internal economic value addition reflects the business unit's economic performance. The revenue from co-processing consists of the waste disposal fee obtained from the waste generator and the benefit of replacing coal or traditional fuel. The costs involve mainly the cost of analytical testing, permitting and approval costs, the cost for operations including the cost of collection, storage, transportation and pre-processing and other fixed costs apportioned such as overhead costs for maintaining facilities, finance costs for investments, commercial and administration costs, knowledge acquisition and training costs, compliance monitoring costs Etc. The economic value added is the net of the cost and the benefit above. The above assumes that a waste-derived fuel mix will not alter the production performance of the kilns, with the assumption that the combustion characteristics of coal are equal to that of the waste-derived fuel. Practically, in the cement kilns, there could be a production loss experienced, mainly if the waste contains added moisture and is fed purely for destruction. Government and the industrial sector should come forward with different suitable strategies to minimize the risk at all levels and do a project for sustainable development. *Sustainable development* is a complex multi-dimensional concept with environmental, economic, social and health issues. Over the past few years, environmental and social concerns around fashion apparel retail business and consumers have become aware of raising the implementation of sustainable initiatives in the global apparel business. For this reason, the global apparel brands are concerned with reducing environmental degradation and improving social values throughout the production chains; for instance, according to a study,

to produce 0.25lb cotton t-shirts, it requires 875 gallons of water, 0.25 lb. of fertilizers, 0.12lb pesticides which emit 6.5lb of CO2, 1.3lb of fossil fuels and 0.1lb hazardous gasses.

Additionally, 50 times are washing and dyeing 0f 0.5lb of a t-shirt in the US on an average of 18.3lb CO2 emitted to the environment. Nowadays, consumers have become more conscious of the unsustainable impact on the environment and are showing their preferences for an eco-friendly products. Therefore, they insist the producer prosecute modern and pure technologies along the sustainable supply chain to produce eco-sustainable products. That means that without upsetting the earth's ecological balance, the ability of something to continue is known as environmental sustainability. Sustainable apparel products mean a part of design characteristics and aptitude towards maintaining ecological balance and social responsibility prevails. Environmental sustainability refers to consuming natural resources and replenishing the product life cycles for longevity. Overall, sustainability impact the environment and product disposed of after their usage.

In the apparel business, sustainable products create a positive impact from manufacturing to product lifecycle. Unsustainable practices can impact every stage of the apparel business, from raw materials to the disposal stage. As merchandisers are the heart of the apparel business, companies can reduce the unsustainable impact through a sustainable environment. Therefore, they must maintain the green merchandising strategy where the apparel products' sustainability could prevail. The erudition tries to show the green merchandising activities and the positive impact of these activities on the environment and society to create a sustainable apparel business environment. However, there are some negative perceptions related to green products due to poor knowledge of consumers related to green products, lower Adaptation intentions and quality issues. Sustainable value generation mainly focuses on idea generation, understanding complex systems, design, system innovation, and sustainable business models. Companies can discover the most important values through mapping in multiple forms.
Values can come in multiple forms. There are several value analysis tools which will identify an opportunity. It consists of posters and cards which help make business decisions and creates sustainable opportunities for customers, employees, the environment, and society. The circular economy focuses on low waste generation and low usage of resources. Also, the companies can minimize the reuse, re-make and re-design the energy usage of the whole manufacturing process leading toward a clean future generation.

5.7.2.9 Implementing green Vendors management inventory model

In recent years the disciplines of supply chain management and logistics have gained a considerable increase in scholarly attention. Such attention is because both areas focus on creating top- and bottom-line improvements by streamlining the flow of material and information across the supply chain (Christopher, 1992). One of the methods for obtaining such advantages is the use of automatic replenishment programs (ARP). The companies use ARP to exchange relationships between buyers and suppliers, where the seller restocks inventory based on information provided by the buyer (Daugherty and Myers, 1999). Geocycle initiated changes in the developing waste management industry, and the regulatory framework associated with co-processing acted as a change catalyst. Most of the permits and licenses obtained for its operations are the first in Sri Lanka, and Geocycle went through a stringent regulatory process while setting a benchmark for the following industries. These include the license to operate a co-processing facility, EPL from BOI to operate a preprocessing facility and the E-Waste Management License issued by the CEA. Geocycle introduced industry best practices, including implementing the six-copy waste manifest system to government control and transfer of hazardous waste. The scientists used to research and development with global practices to invent the technology for preprocessing and handling hazardous waste to create a cycle and develop a partner network along its supply chain. Some partners were selected to divert the waste to the most sustainable solution, such as virgin material recyclers and paper recyclers. Partners also handle the wastes, such as electronic waste, that cannot be co-processed in the cement kilns. The value added to the partner network is building competencies and promoting best practices and entrepreneurship in the industry. Geocycle establishes its health, environmental and safety standards in operations, and the improvement of working conditions of more than 200 waste collectors who collected waste in the KEPZ open dump yard by bringing them under a sheltered space is one example. An assessment of the employment created by Geocycle operations in 2010 is approximately 65 full-time employees and about 900 indirect employees through channel partners. Examples of these are continuous replenishment planning (CRP) and vendor-managed inventory (VMI) (Disney Potter and Gardner, 2003; Boride and Ban sod, 2009), with the latter referred with consignment inventory (Dong and Cu, 2002). Of these examples, VMI is a unique approach in that VMI stresses the responsibility of vendors in inventory management. Benefits emanating from this concept include but are not limited to higher selling space productivity, increased sales per store for

retailers and improved control of the bullwhip effect (Waller, Johnson and Davis, 1999; Angulo, Bachmann and Waller, 2004). Research on inventory management in general and VMI, in particular, has intensified in the recent decade (Williams and Tovar, 2008). These are, for instance, related to forecasting issues (Vigil, 2007), planning nervousness (Kaia, Korhonen and Partial, 2006) and obtaining accurate estimates of production lead times (Disney and Twill, 2002). The majority of the extant literature on VMI has investigated such issues via mathematical modelling, although it is continually stressed in these papers that such models carry several limitations that might cause those models to be unrealistic (Smarts, Lehtonen, Appelqvist and Holmström, 2003). Others have researched the VMI concept via case studies (e.g. Holmström, 1998). These papers investigate VMI from a focal perspective, which is surprising when one notices that VMI focuses on the collaborative and, therefore, inter-organizational issues of managing inventory. This study has led contemporary VMI studies to place little emphasis on the inter-organizational and managerial aspects of VMI implementation, even though such studies have made repeated calls. For instance, Pollen and Gold (2003, pp. 579) has suggested that as regards VMI Adaptations, "further empirical research is required to determine how the availability of information affects management decision making" and that "case study analyses will be required to capture cost and performance information across supplying and purchasing firms." Waller et al. (1999, pp. 198) noted that "*successful implementation depends heavily on good business processes and interpersonal relationships, [where] a purely technical solution without regard for the people involved is unlikely to deliver the benefits* ".

Similarly, the study suggested that "*an area of future research that may benefit inventory management is incorporating behavioural issues*" (Williams and Moore, 2007, pp. 228). In a review of inventory management research, Williams and Moore (2007, pp. 228) claim that "*inventory management models do not adequately account for behavioural issues and the judgment and decision making of managers*. *As a result, there may be a constraint regarding predictive accuracy of such models*." Answering such repeated calls for research on VMI's inter-organizational aspects would be valuable, as it would deepen our understanding of the relevant features of VMI and buyer-supplier relationships. Since VMI originally was meant as a collaborative approach, in which both buyers and suppliers should cooperate in order to benefit from its implementation, this paper, therefore, aims to "explore how the extant literature has treated VMI and subsequently demonstrate the importance and necessity of implementing

VMI from an inter-organizational perspective." The researcher answered the initial section of the research questions using a comprehensive literature review and exploratory single case study "Vendor Managed Inventory" and "VMI" involving a focal company implementing VMI with one of its most important customers to answer the latter. The paper is structured as follows to investigate the issue. In section two, a literature review considers VMI-related contributions. For the literature review of this study, the researcher has taken the journals and papers from Science Direct, Wiley-Inderscience, Emerald and EBSCO HOST's databases Business Source Complete, Business Source Premier, Academic Search Premier and Academic Search Complete. The employees systematically search for the key terms "Vendor Managed Inventory" and "VMI" so they could appear either in the title, abstract or keywords. The majority of papers (a total of 44) identified through the literature review deal specifically and meticulously with mathematical modelling of VMI, for instance, Wilson (2007) and Yao and Dresner (2008). Most common approaches use mathematics to arrive at models that could predict deterministic or stochastic demand on inventory (e.g. Lee and Cho, 2014). Others use empirical data to describe VMI-related aspects via simulation models (e.g. Southard and Swenseth, 2008). Although such articles are relevant inasmuch as they highlight how certain variables behave under fixed circumstances, they carry certain limitations in that they can only take into account a limited number of variables. Almost all researchers approaching the issue of optimizing VMI relationships admit that this is a limitation of these studies. For instance, Småros et al. (2003, pp.351) noted that: "more case studies focusing on companies that have implemented VMI and studying the benefits they have attained as well as the problems they have faced in practice are needed. This literature is the only way to get reliable information on the companies' actual processes and the important relationship issues that are so critical to the success of collaborative approaches such as VMI." A smaller part of the extant literature (a total of 6 papers) consists of literature reviews or normative discussions to ponder various aspects of VMI. For instance, Blatherwick (1998) and Cooke (1998) discuss the diffusion of the VMI concept and its possible effects and success factors in practice. In a third paper, Barratt (2003) calls for further research on verifying the actual economic benefits of VMI, while Pohlen and Goldsby (2003) investigate the organizational barriers to why VMI is not implemented more often in firms. They conclude that further empirical research is necessary to execute the VMI applications. Williams and Tokar (2008) conducted a theoretical review of inventory management research in major logistics journals, pointing out that further research is necessary on more complex VMI settings not designed by mathematical means. Zammori et

al. (2009) discuss how standard agreements can be applied effectively in VMI settings. Another part of the literature (a total of 7 papers) uses quantitative data to test various hypotheses. Waller et al. (1999) theoretically explain why savings potentially can accrue from VMI for both suppliers and buyers; nevertheless, they do not provide empirical support for this. Kaipia et al. (2002) use a simulation approach based on quantitative data on inventory demand to analyze VMI's benefits from managing the replenishment process of the entire product range. They claim that "there are numerous case examples of successful VMI implementations", although the studies they point to (e.g. Cooke, 1998 and Holmström, 1998) do not contain empirical proof for successful VMI implementations. Kuk (2004) found that a lack of trust can be a major barrier to effective VMI Adaptation, while De Toni and Zamolo (2005) use a simulation model based on quantitative data to argue that VMI can be a successful initiative. Their approach is purely technical, making only a minor reference to inter-organizational aspects of the VMI relationship between the buyer and supplier. The article stated that the change from the logic of traditional replenishment to the VMI approach has provided significant advantages for all involved in distribution and supply chain." Nevertheless, their empirical account only focuses on the benefits of VMI on the focal company, with no attention or empirical data given on how suppliers reacted or benefited from it. Dong et al. (2007) tested various determinants of VMI Adaptation, while Casen et al. (2008) investigated performance outcomes of VMI via a structural equation model focusing mainly on the buyer's side. Similarly, Borade and Bansod (2010) surveyed drivers and obstacles to VMI in an Indian context while focusing exclusively on the buyer's side. In conclusion, the analyses conducted in these studies provide fruitful insights on VMI Adaptation but do not investigate an active inter-organizational involvement between buyer and supplier. The last group of studies relies on qualitative data (13 papers). Most of these studies limit their analysis to a focal perspective with some brief references to inter-organizational issues. For instance, Walton (1996) briefly mentions VMI in electronic data interchange, while Holmström (1998) mentions some inter-organizational issues without showing empirical evidence. Tan and Wee (2003) studied an Adaptation of VMI between two companies in the Taiwanese grocery industry. However, they focus on the focal company, not providing an account of how the VMI implementation affected the supplier's cost structure. Dorling et al. (2005) and Dorling et al. (2006) studied key determinants of VMI projects in the New Zealand food industry, developing an organization-level framework for VMI implementations. Kaipia et al. (2006) investigated the connection between the bullwhip effect and planning nervousness in VMI-related situations, while Vigil

(2007) specifically focused on the type of information exchanges firms utilize in VMI projects. Tanzanian et al. (2009), Guimarães et al. (2013) and Stanger (2013) all investigated VMI benefits from a focal perspective, with Elvander et al. (2007) categorizing different types of VMI systems via dimensions, for instance, inventory locations, sourcing policies or shipment decisions. A few of the above-given papers involved some analysis of VMI's inter-organizational aspects. For instance, Blackhurst et al. (2006) analyze the gaps between the expected and actual effects of two VMI initiatives. The authors audit the processes of two supply chains and suggest that shortcomings in collaboration between the partners caused material shortages and low levels of inventories in both VMI initiatives. Another study that sheds light on inter-organizational relationships is by Kauremaa et al. (2009). They provide a snap-shot picture of five different VMI dyads and report the shared benefits between suppliers and buyers. While these studies point to the importance of collaboration and the benefits of VMI on both parties in a supply chain, they do not provide data on the change that VMI implementation brings and collaboration between buyers and suppliers on their common goals, cost analysis and the performance of the resulting supply chain. The present paper aims to fill this gap.

This investigation recommended that the Cement Manufacturing industry recognizes its key drivers and concentrates on the following essential areas. Cement companies are naturally not involved in regular communications with their local, national, or international stakeholders to converse their concerns and classify solutions. The study established an understanding of the need for stakeholder contribution and shaped a guidebook to help cement plant and corporate communications staff in increasing additional practical outreach efforts.This study recommended that environmental innovation through reducing environmental impact can improve the economic support of sustainability. The latter can moderate the problem related to the double externality of environmental innovation and firm underinvesting in environmental innovation.

Improved association among cement companies and their stakeholders is necessary for many sustainable development features. The study recommended actions to improve interactions among governance bodies, suppliers, customers, academia and the local stakeholders near cement plants. One recommendation is to start the Sustainable Development Institute of

Cement and Concrete to facilitate joint research, develop educational programs, and integrate cement industry inputs to governments in developing and assessing policy options.Sustainability studies usually include recognizing and addressing environmental, social, economic and governance matters that arise through product development or manufacturing cycles.Regarding the different designs of economic development, current industrial structure, management level, and solutions for green value creation are place-specific and require a high degree of contextualization. In some cases, the economic opportunities associated with the emerging green economy/ markets will trigger the build-up of new orders and sources of competitiveness for the industrial market and provide new foundations for green sustainable performance. In other words, new environmental options may exert a strong pull and lead to changes in industrial performance and development levels.

5.7.2.10 Implementing Green Audit

Cement manufacturing significantly impacts the ecological environment from "quarry to lorry". The process of excavation of limestone, starting from the raw material crushing and milling, clinker manufacturing, cement grinding, and bulk and bag material, transportation demands the use of natural resources in the form of material and energy. Driving sustainability initiatives in the cement industry have gained focus over time, and reducing the non-renewable energy usage in the thermal process of clinker manufacturing has been identified as a critical area to drive. The coal and heavy furnace oil supply the cement kiln's thermal energy demand, as the traditional manufacturing process is a non-renewable energy source. The initiative to replace traditional fuel using alternative fuel derived from industrial wastes unfolds the cement industry to drive sustainability in two aspects. Firstly, through replacing coal and hence conserving non-renewable energy and secondly, through making the cement kilns available under controlled conditions to thermally destruct hazardous and non-hazardous waste and thereby providing an environmentally sound final destination to dispose of their waste to the industrial waste generators. The paper discusses how the cement industry in Sri Lanka, specifically the only fully integrated cement manufacturing facility operated by Holcim (Lanka) Ltd., derives this model from delivering sustainability in the cement industry. The cement industry has an environmental impact on each of its manufacturing processes. Quarrying results in changes in the landscape and deforestation which impacts biodiversity, soil, waterbeds and mineral dispersion in the land. All mechanical processes, including

crushing limestone, raw milling, cement milling, coal milling and conveyance, packing and finishing goods transportation, result in fugitive dust emissions and energy consumption for mechanical activity. The chemical process of pre-heating the kiln feed and calculations involves the consumption of energy and, more importantly, the use of non-renewable energy in the cement kilns for heat generation. In addition to the combustion process, calcination during clinker manufacturing also results in CO2. Overall, cement manufacturing is a highly energy-intensive process and the main contributor to global CO2 emissions.

The cement industry contributes 2% of global primary and 5% of global industrial energy consumption. It also contributes to 5% of total global CO2, per the World Energy Council (2005). Cement Industry Environment Report (2003) Cement Industry Federation, Australia provides the breakdown of greenhouse gas emissions of the cement industry as 52% resulting from the chemical process of making clinker, 36 % from the combustion of fossil fuels in the kiln and 12% from indirect emissions from purchased electrical power. Coals and carbon-intensive fuels increase the CO2 emissions in the combustion process by cement kilns to generate heat in the claiming process. The specific process of CO2 emission for cement production depends on the ratio of clinker/cement, and this ratio varies typically from 0.5 to 0.95 as per Roemer (2004) Emission Reduction of Greenhouse Gases from the Cement Industry. The total CO2 emission during the cement production process depends mainly on the type of production process (efficiency of the process and sub-processes), the fuel used (coal, fuel oil, natural gas, petroleum coke, alternative fuels) and the clinker/cement ratio (percentage of additives). Thus, to reduce adverse environmental impact, the industry must focus on reducing CO2 emissions. Regarding increasing sustainability, technology's impact is significant from two different points of view.

On the one hand, technology helps organizations address environmental issues (virtual meetings, dematerialization of activities, improvements in logistics, intelligent transport systems, smart grids, Etc.); on the other hand, technology is itself responsible for significant environmental degradation (e.g., the amount of energy consumed by engineering processes used to manufacture technology products). In this sense, Erdélyi emphasizes that Information Technologies (hereafter "IT") can contribute to environmental sustainability in two ways: "Green by IT", in the sense that IT can provide tools to carry out tasks in a way that is suitable for the environment (i.e., IT as an enabler in the direction Unhelkar) pointed us in, and "Green

in IT" when It is themselves have an impact on the environment, due to energy consumption and emissions from the IT elements themselves (i.e., IT as a producer). "Green IT" often combines Green by IT and Green in IT. The focus of this study lies within the field of Green in IT, specifically in identifying standards or frameworks to control the correct implementation or operation of Green in IT, especially regarding its auditing. Within Green in IT, the reduction of energy consumption has been addressed in different projects in cloud computing, hardware, data centres, Etc., but not in its audits. From the point of view of the audit, there already exists an IT framework for auditors, developed by ISACA (Information Systems Audit and Control Association), called COBIT 5 (Control Objectives for Information and related Technology), which has its origin in the control and auditing of IT. COBIT 5 has a series of guides and professional frameworks for the governance and management of different areas of IT. While it is true that this framework provides a relatively broad overview of everything related to IT, and there are versions adapted to specific areas such as security, COBIT does not yet have any version or control mechanism related to Green IT or sustainability.

They are employing more energy-efficient processes (e.g. from wet to semi-wet or dry process. While in a dry process, the raw meal is pre-dried and even pre-calcined before entering the rotary kiln. the raw meal is fed to the process with high moisture content directly into a long rotary kiln. Therefore, material preparations and evaporation of the moisture content cause total energy consumption. That is the remarkable difference between energy consumption in these two processes. It is possible to save up to 50% of the required energy and reduce 20% of CO2 emissions by shifting to a dry process with a calciner from a wet process. The manufactuiring plants have energy consumptions at 90% in the pyro-processing unit, including the preheater tower, calciner, kiln, and coolers. Therefore, reduction of thermal heat losses in the pyro-processing unit in the cement plant. Pipes, cyclones' shells, and leaking air causes energy waste in the preheater tower. Moreover, leakages, surface and shell in the calciner and the kiln cause a noticeable amount of thermal energy loss. In addition to heat losses in the heating part, the cooling part also wastes some heat in the plant. These losses can be due to leaking air and coolers' surfaces. In general, heat losses in pyro-processing units can lead to wasting up to 20% of initial energy, resulting in the release of 8% extra CO2 from cement plants. Secondary shell and insulation layers lose through shell and surface in certain situations. While in case of air leakages, proper sealing methods and regular monitoring and maintenance have been proposed and implemented. These approaches have significantly reduced energy losses in the process.

3) Energy recovery from exhaust streams other sources of thermal heat loss in pyro-processing units are flue gas and hot air streams. 35% of total energy waste to recover and reuse these thermal energy sources. Therefore, different technologies can be implemented depending on the volume and temperature level of exhaust streams as well as location and the need of the process in some works waste, heat recovery systems have been proposed to generate electricity from these two streams. These systems produce 30-45 kWh/t-clinker electricity in giant kilns. In other cases, the manufacturing plants use exhaust streams to produce steam or hot water used in the process and in some others, these energy sources are sent to the vicinity demand side to provide a part of the required thermal energy, especially for heating space. Electrical energy savings Electricity consumption contributes to almost 5% of carbon dioxide emissions in the cement plant. To operate an efficient cement plant, it is essential to have approximately 100 kWh/t-cement electricity. Considering coal as the primary fuel, we can see that this electricity demand produces up to 100 kg of CO2 per ton of cement. An example of strategies toward electricity saving is utilizing adjustable speed drivers instead of typical drivers. This substitution can save electricity from 7 to 60% based on application and the load applied to the motors. New preheater tower and kiln burners Utilizing new and optimized types of cyclones are estimated to save 0.6-1.1 kWh/t-clinker electricity by reducing pressure drop. Using new and optimized models of burners can also result in fuel savings. These burners can lead to a stable kiln operation, maximizing combustion effectiveness and reducing fuel consumption. Regular maintenance can significantly contribute to energy saving and curbing CO2 emissions. Actions such as regular leaking monitoring and control, corrosion control, and reduction, as well as periodical replacement of old motors and machines, can significantly increase the plant's thermal efficiency. Simple air leakage at the kiln hood could lead to approximately 46 kJ/kg-clinker energy losses. B. Strategy. Post-combustion CO2 Capture and Storage Against all approaches described above, post-combustion CO2 capture and storage (CCS) never actually reduces the generation of CO2. This treatment aims to separate, capture, and prevent CO2 from being released. CCS is a set of technologies which can considerably mitigate CO2 emissions from industrial processes and other stationary sources of CO2. It is a three-step process which includes capturing and compressing CO2 from flue gas streams, transporting the captured CO2 (usually by pipeline system), and storing CO2 in appropriate geologic formations. However, up to now and due to various technical and economic barriers, no post-combustion capture and storage process has been applied in cement plants. Many organizations didn't see the broad deployment of CCS in the cement industry before 2020. C. Strategy 3:

Utilizing Alternative Materials In cement production is not new. In future, utilizing alternative materials has rapidly extended due to the prospect of energy and environmental challenges. 1) Alternative fuels utilization Plenty of alternative fuels, in different phases, are used in global cement plants to obtain economic and environmental achievements. These fuels generally include 1) Agricultural biomass residues, 2) Non-Agricultural biomass residues, 3) Petroleum-based and miscellaneous wastes, and 4) Chemical and hazardous wastes.

5.7.2.11 Implementing Green quality assurance standards

Dual Role of Co-Processing The cement kiln requires a uniform quality fuel mix to have stability in the combustion process in the kiln. Using waste-derived fuel imposes the challenge on the process engineers and production managers to supply a homogeneous fuel mix derived from different waste types with varying quality. To face this challenge and to ensure environmental and regulatory compliance in co-processing, it is critical for the cement companies carrying this activity to have a dedicated unit to perform the below two prominent roles. One is to provide waste management solutions by operating at the front end to secure waste sources to be directed to the cement kiln and provide a service to the waste generators by providing a solution to the waste. This part of the organization operates as a service organization in the waste management/ environmental industry, focusing on the needs and wants of the waste generator. Two is to provide an alternative fuel to the cement kilns by preparing a waste-derived fuel, which can be substituted in the cement kilns as an alternative fuel and supply a constant quality alternative fuel source to the cement kilns. It is required to maintain facilities to pre-process waste to bring them to a homogenous quality and to work closely with the cement plant to supply a fuel mix meeting their specifications. Green value chain management aims to cater to rising consumer demand and boosts competitive advantage (Revilla and Knop pen, 2015; Skelton, 2014; Spring and Araujo, 2014; Zhang et al., 2016). Recently, businesses have taken up green value chains via integrating conventional Green Value Chain methods with environmental consciousness to comply with legislation, transform their businesses to be environmentally friendly and ensure customer satisfaction.

In contrast to the classical green value chain management, the green value chain method requires that actions such as procurement, shipping, production, Etc. are taken from an environmental point of view (Revilla and Knop pen, 2015; Skilton, 2014; Spring and Araujo, 2014; Zhang et al. 2016). Businesses should pay utmost attention to developing safe and

reliable products, prefer more environmentally friendly production phases/lines, reduce toxic wastes, develop environmentally friendly packaging methods and act with a particular environmental awareness (Srivastava, 1993). While phases that require relatively more managerial scope than technical expertise, like logistics and procurement, are focused upon during the first few years following the emergence of the green value chain, reverse logistics through the environmental perspective has integrated with logistics and marketing in the later periods (Sarkis et al., 2011).

There are three parts to the green value chain's advantages: legal, social and commercial. Businesses implementing a green value chain can more easily comply with environmental laws, minimizing the potential compliance risks. On the social side, decreased energy consumption, waste production, emissions, environmental thread risks, raw material consumption, noise and radiation and risky material consumption contribute to improving employee and community health. In addition to all these, commercial benefits of a green value chain include increased access to the market, improved environmental performance, higher customer satisfaction and confidence, improved brand value and reputation, higher product and service quality, increased competitive advantage and market share, accelerated technological development and increased performance (Zhang et al. 2016). Moreover, the companies incurred fewer expenses for trading/transaction, energy, material, disposal and storage. Despite all these advantages, the green value chain requires significant capital expenditures and a highly-skilled R&D department, causing significant economic difficulties for small and medium enterprises upon decision to undertake the green value chain. The drawback of the green value chain is the hike in raw material costs, testing costs, investment expenditures as well as the time spent conducting research and development (Creswell, 2014; Revilla and Knoppen, 2015; Skilton, 2014; Spring and Araujo, 2014; Zhang et al. 2016).

The green value chain is an integrated formation consisting of multi sub-systems. For its practical application, these sub-systems and their components must be understood in depth and implemented successfully. Major Root causes for a successful green value chain are green procurement, green manufacturing, green distribution, green packaging and reverse logistics (Dawes, 2009; Knight and Jenkins, 2009; Zhang et al., 2015). Green procurement involves "purchasing involvement in activities that include the reduction, reuse and recycling of materials" (Carter and Ellram, 1998). Green procurement is the procurement of environmentally-friendly materials that are either recyclable (Sarkis, 2003). Businesses

implementing green value chains to conduct market research to pursue and improve green procurement strategies and aim to increase the maturity and competency of the business in selecting environmentally friendly raw materials/inputs. Green manufacturing is conducting manufacturing processes by considering environmental factors and re-designing and implementing those through ecological and environmental perspectives. This manufacturing method also encompasses retrieving used products and re-launching those after being put through specific processes (Dawes, 2009; Knight and Jenkins, 2009; Zhang et al., 2015). Green manufacturing ensures minimizing inputs/ raw materials utilization and damages/ threads incurred to the environment by ensuring that products are recyclable and reusable. Green distribution aims to identify and utilize shorter routes, reduce storage space/area and avoid holding unnecessary inventory. The main factors triggering dangerous gas emissions and carbon dioxide particles within the Green Value Chain are distribution and transportation practices (Paksoy et al., 2011).

Moreover, as vehicles and types of combustibles utilized in distribution also bear critical importance, utilizing railways instead of highways could incur economic benefits for businesses and create positive environmental externalities. Transportation/transmission of products in large bulks, utilization of noise inhibiting devices in vehicles, usage of environmentally friendly vehicles and effective vehicle routing are crucial in implementing and maintaining efficient green distribution (Knight and Jenkins, 2009). *Green packaging* is eco-friendly and environmentally-conscious packaging that ensures recyclability and reusability and supports sustainable development. It is a method of packaging that supports recyclability and reusability and does not create negative externalities such as pollution or threads on community health (Zhang and Zhao, 2012). Process and product re-designation to better enable recycling, cost reduction, enhanced utilization of environmentally friendly materials, and avoidance of petroleum-based plastics usage could be the main objectives of undertaking green packaging. Reverse logistics is the systematic acceptance of products and parts previously sent from consumption points for re-manufacturing or disposal (Dowlatshahi, 2000). Reverse logistics re-design Green Value Chain to manage re-manufacturing, recycling/refurbishing and product/material flow. Reverse logistics management is examined in six parts: acceptance, reuptake, revision, renewal, transportation and re-engineering (Giuntini and Andel, 1995).

In early 1960, the Sri Lankan cement corporation, the government-owned entity, was the first fully integrated manufacturing cement plant in Sri Lanka in the northern province of Sri Lanka

in the town of Kankesanthurai under the name of "Kankesan Cement". Within the next ten years, the company established two other cement manufacturing plants in Sri Lanka located in Puttalam and Galle, which operated under the brand name of Sanstha" under the sole ownership of the Sri Lanka cement corporation. The private sector entered the market in 1982 when Sri Lanka opened its doors to the first Japanese-based manufacturer in Sri Lanka, TOKYO super cement Lanka Limited, a semi-integrated cement manufacturing plant established in the town of Trincomalee. In 1983, the government privatized the cement operating point in Galle under the company name Yahola Enterprises Pvt. Ltd that manufactured products under the brand name of Rehung Cement. The civil unrest that shook the nation for nearly 30 years and security concerns made it impossible for the local government to operate the cement plants in Kankesanthurai and Puttalam. As a result, the cement plants were shut down in 1996 due to civil unrest. Holcim was the second manufacturer to enter the market. In 1996 entered the local market by acquiring the Puttalam cement plant from the government. As Holcim was an international brand, they had no issues operating in areas consistent with civil unrest as the private organization did not have any political or ethnic lenience. Holcim had acquired the manufacturing plant in Galle and continued to corporate on the same brand name, "Sanstha."
Tokyo Cement Lanka Limited and Holcim cement are the only two local manufacturers that currently mass produce cement in Sri Lanka (Holcim Annual Report, 2017). Research conducted by the JKSB indicated that Sri Lanka's cement consumption was approximately 4.2 million tons per year in 2010, accounting for 1.4 million tons of cement production from Holcim and 2.4 million tons of cement production from Tokyo cement. Tokyo Cement Corporation is the market leader, holding on to nearly 30% of the market share as of 2014 and selling its products under the brand name Tokyo super. Holcim Controls about 20% of the market share, with another three retailers attributing for the balance 38% share with an overall 12% attributed to direct imports. At the same time, Holcim and Tokyo are the only two full-service manufacturers who conduct operations from the mining of limestone to the packaging of cement in bags for distribution; ultra-tech, Lafarge and Singha bulk import cement and clinker that is processed and re-packed for distribution along the country. Overall, the cement manufacturing sector of Sri Lanka creates those values supported by comprehensive supply chain management strategies, innovative sustainable business practices and community marketing activities. However, fewer empirical studies reveal the outcome of those practices than it usually seems in industrial sector organizations (Central Environment Authority of Sri Lanka –CEASL, 2017; Munasinghe and Dissanayake, 2018).

Sulfur oxide (SO2) Sulfur is essentially present all together cement stuff. The combustion of Sulphur fuel and oxidation of Sulphur in stuff forms the Sulphur oxides. Emitted Sulphur oxides react with vapour and different chemicals in the atmosphere within the presence of daylight to make acid. The workers washed acid fashions using acid rain. It decreases agricultural productivity and will increase the death of plants. It additionally causes metastasis downside known as respiratory disease. Carbon dioxide and CO Cement industries are the essential supply of CO2 emissions. It is calculable that fifty% of total CO2 emission is from cement industries. CO2 generates from fuel combustion and decarbonization of raw materials. The alternative supply of CO2 emissions is the fuel used, transportation and energy from execution to disposal. CO2 is accountable for the international climate amendment and different metabolic process illnesses and asthma attacks on the soul. CO causes health impacts by reducing chemical element delivery to organic structure and causes an effect on vas and the central system. The experts tested carbon dioxide capture technologies for the cement industry. The main drawback of the capture technologies is the boiler's high amount of regeneration energy requirement. Nitrogen oxide (NO2) NOx is a creation derived due to thermal oxidation in the temperature range of 1200-1600℃. The family of nitrogen oxides includes nitrogen dioxide, nitric acid, nitric oxides, nitrates, and nitrous oxides. Because of the variety of family compounds, nitrogen oxide is responsible for many effects. Nitrogen oxide reacts with water to form various acidic compounds. These acidic compounds acidify lakes and water sources, creating difficulty for aquatic animals' survival. It is also responsible for global temperature increases in the high range. When breathed, the smog created by Nitrogen oxide causes respiratory diseases. It creates difficulty in breathing and chronic lung diseases. It may ultimately result in cancer diseases.

5.7.2.12 Accounting system implementation on Green costs in HOLCIM and general industry

Understanding the current direction of the global market and the increased pressure cement manufacturers will have to use more-cleaner sustainable manufacturing methods in the coming year, Holcim Lanka will adopt a new strategic direction to manufacture and promote more blended cement or application-based cement in the future as a recommendation.

The premise is that this direction will be inevitable in less than ten years in developing and emerging markets as environmental pollution becomes a considerable concern with more projects and the demand for cement increases. The feeling is that local governments will increase pressure in these markets for cement manufacturers to be more environmentally responsible, and the direction of the industry will gradually shift towards using blended cement. The organization sees the new strategy as a *first into the market*, giving them a competitive advantage over competitors when the direction moves more towards blended products. The new strategic direction will not deviate from the current corporate mission parameters by promoting more application-based cement but will reinforce the statement of *providing value to all stakeholders* by taking a more environmentally responsible route.

5.8. Limitations of the research

This study provides empirical evidence on the relationships between Green Value Creation and Sustainable Performance in the context of Cement Manufacturing in Sri Lanka. Furthermore, it also provides an insight into the mediating role of Environment Innovation. The study is limited to some constructs, and researchers can add different constructs as mediators. The researcher did not consider the outcome of many variables with the data collection limitations.

While difficulties particularly relate to national and international regulatory frameworks, chances have a qualitative impact on sustainability management programs. Though the qualitative shift in favour of thriving maritime training is attributable to such variables as infrastructure and regulations, the essential for creating a better consciousness amongst possible trainees in the cement manufacturing industry of Sri Lanka is quite comprehensible.

The findings of this investigation are interpreted in light of a few limitations together with the findings. There is limited local literature about green value creation and sustainable performance since this idea is new. The analyst thought it was essential to making literature to the local context. The limited sample population for both the questionnaire and the survey is unlikely to permit the researcher to draw broader conclusions on the implications of the research program.

In addition to the above, this study is a cross-sectional study and not a longitudinal one. Therefore, it can also be considered a limitation where the respondents are examined only once. In that capacity, the conclusions produced using this investigation remain constant for a

particular period and sample and may not be generalizable to a more significant population and in various contextual settings.

The discoveries might be restricted to the Cement Manufacturing Industry only. Thus, future research should endeavour to gather data from organizations in the service industry, like hospitals, hotels, airlines, and restaurants. In this manner, an examination of the diverse organizations in the manufacturing industry can be procured.

5.9. Directions for further research

Future studies should include other constructs such as Supply chain, lean management or social responsibility to get a more comprehensive model of the factors affecting Sustainable performance in the Cement Manufacturing industry. Based on the theoretical study of Hart (1995), the study can hypothesize that environmental and product innovation can be interdependent. Future researchers can address this issue can be in their studies. Suggestions for further research would be a comparative study to test the relationship between the different concepts and how they affect each other. Future research can include a greater diversity of products and services and the Green Value Creation as employees. The questionnaire required that the employees respond to several adjectives that agreed in varying degrees to their perception of their specific organization. *Green value creation* is a compound construct that is hard to measure in a way suitable for all Cement Industry employees in different geographic locations. Other studies should evaluate alternative methods of evaluating green value creation. Comparative study between different Cement Companies undertaken.

The study was regarding the organizations in the Cement industry in Sri Lanka. More research is needed in other industries and countries since the study includes environmental commitment, supply chain, and social responsibility, which can differ in other parts of the world.

A recommendation is to do a longitudinal study to see changes and improvements over time since this research only did a cross-sectional study at one point. Studies must investigate the strength of the relationship of the main variables since the relationship between green value creation, environment innovation and sustainable performance was not proven robust, and what it takes to make Sustainable Performance.

Future research exertions can consider buyer-related variables such as the size of the organization, practices in the cement industry, market pressures and cost pressures on the green supply chain members. The decision-making theories can also be of great use for the companies seeking to improve the priority of the practices in the market to improve the best possible outcome, environmentally, economically, and socially.

In addition, the researchers can use moderation tests by using other methodological variables. Suggestions for additional research would be a similar report to test the connection between the different concepts and how they influence each other.

Finally, conducting a study on Sustainable Performance is suggested using a qualitative method. Next, the results, a conceptual model of Sustainable Performance, would be quantitatively verified. Furthermore, this study, an explorative study on the tangible and intangible cost of Sustainable Performance in Cement Industries, would increase awareness and importance of the topic of Sustainability.

5.10. Chapter Summary

This doctoral research has looked to extensively inspect the "relationship between Green Value Creation, Environment Innovation, and Sustainable Performance of employees in the Cement Manufacturing industry in Sri Lanka".

This examination has expanded the written works connecting green value creation, environment innovation, and thus sustainable performance. This investigation has uncovered that green value creation has significant connections to sustainable performance. What is more, Environment innovation assumes an essential part in clarifying sustainable performance. The trial of mediation featured the meaningful interaction of Environment Innovation on the underlying connection between "Green Value Creation and Sustainable Performance of Employees in the Cement Industry in Sri Lanka". Subsequently, the findings are predictable, recognising the impact of a mediating variable amongst exogenous and endogenous variables. As discussed, the study depicts a discourse of the outcome and what may have influenced it.

The study introduced some theoretical and managerial implications, and managers were encouraged to instruct their employees on more environment innovations. In the restriction

part, it was cleared up. Sustainable performance is committed to employees who have a positive environment of innovation. For future research, different elements that may impact environment innovation could be viewed and applied to different scales, methods, variables, and sectors with comparative analysis directed. It would likewise be desirable to do this investigation in various industries.

References

Alvarez Gil, MJ, Jimenez, JB and Lorente, JC. (2001), 'An Analysis of Environmental Management, Organizational Context and Performance of Spanish Hotels. Omega journal, 29, 457-471.

Allenby, S, Richards, D. (1984). *The greening of industrial ecosystems*. Washington: National Academic Press.

Allenby, S, Richards, D. (1994). *The greening of industrial eco-systems.* Washington: National Academic Press.

Allis, A, K.C.A. Fernando (2016).*Life cycle assessment (LCA) analysis towards a sustainable cement industry for Sri Lanka: an analysis of three process pathways,* Department of Chemical and Process Engineering, University of Moratuwa.

Amit, R and Pratik, M. (2012), 'An empirical study of green supply chain management drivers, practices and performances': with reference to the Pharmaceutical Industry of Ankleshwar (Gujarat), International Journal of Engineering and Management Sciences, 3, 39-355.

Antoniou, P.H., Levitt, C.E., and Schreihans, C. (2011). Managing Value Chain Strategy. Interdisciplinary Journal of Contemporary Research in Business, 3(8).

Arachchige, U.S.P.R, Kawan, D, Tokheim, L.A and Melaaen, M.C (2012), *"Model development for CO2 capture in cement industry,"* International Journal of Modeling and Optimization, vol. 3, no. 6, pp.535-540, 2013.

Arena, U, Mastellone, M. L, and Perugini, F. (2003). *The environmental performance of alternative solid waste management options:* A lifecycle assessment study. Chemical Engineering Journal, 96, 207-222.

Ari, V. (2016), "*Energy auditing and recovery for dry type cement rotary kiln systems -a case study*," Energy Convers. Manage, vol. 46, no. 4, pp. 551-562, 2005.

Ashley, S. (1993). *Designing for the environment. Mechanical Engineering*, 115(3).

Azevedo, S., Carvalho, H., and Cruz-Machado, V. (2011). The influence of green practices on supply chain performance: A case study approach.

Azin. R (2016) "*Techno-Economical and Environmental Study of Utilizing Alternative Fuel and Waste Heat Reuse in a Cement Plant*," Energy Science and Technology, vol. 2, no. 1, pp. 25-34, 2011.

Banbury, J.G. (1975). *Distribution – the final link in the electricity–supply chain.* Electrics and Power Journal of the Institution of Electrical Engineers, 21(13), 773-775.

Barros, A. I, Dekker, R, and Scholten, V. (1998). *A two-level network for recycling sand: A case study. European Journal of Operational Research*, 110, 199-214. Beamon, B. (1999). Designing the green supply chain. Logistics Information Management, 12(4), 332-342.

Benhelal, E and Haslenda, H "*Technical cement process simulation and environmental advantages of alternative fuels utilization,"* UMIES conference, University of Malaya, Kuala Lumpur, Malaysia, vol. 29, pp. 12-14, July 2011.

Benhelal, E, Azin, R and Raad, S, "*Techno-Economical and Environmental Study of Utilizing Alternative Fuel and Waste Heat Reuse in a Cement Plant*," Energy Science and Technology, vol. 2, no. 1, pp. 25-34, 2011.

Benhelal, E, Zahedi, G, and Haslenda, H "A *novel design for green and economical cement manufacturing*," J Clean Prod., vol. 22, no. 1, pp. 60-66, 2012.

Bolio.H (2016), "*Sustainable cement production--present and future,"* Cement Concrete Res., vol. 35, no. 8, pp. 2015.

Brass, B, and McIntosh, M. W. (1999). *Product, process, and organizational design for remanufacture - an overview of research.* Robotics and Computer-Integrated Manufacturing, 15, 167-178.

Bryson, J.M. (2018). Strategic planning for public and non-profit organizations: A guide to strengthening and sustaining organizational achievement. John Wiley and Sons.

Burnes, S. (2002). The mobile commerce value chain: Analysis and future development. International Journal of Information Management, 22(2), 90-108.

Cairncross, F. (1985). *Costing the earth.* Boston: Harvard Business School Press.

Caruso, (2016) "*Analysis and optimization of carbon dioxide emission mitigation options in the cement industry, American."* 1st edn Journal of Environmental Sciences, vol. 5 2010.

Carter, C.R, and Ellram, L.M. (1988). Reverse logistics: A *review of the literature and framework for future investigation. Journal of Business Logistics,* 19, 85-102.

Chen. C, Habert. G (2016), "*Environmental impact of cement production: detail of the different processes and cement plant variability evaluation*," J Clean Prod., vol. 18, no. 5, pp. 478-485, 2010.

Chadwick, C. (2017). Toward a more comprehensive model of firms' human capital rents. Academy of Management Review, 42(3), 499-519.

Chen, S. (2009). Service culture and its impact on service innovation: Based on the model of service value chain. International Conference on Management and Service Science, 20-22.

Christensen.K.P (2016), "*Improving fuel consumption and emissions by means of modern cooler, cyclone and calciner technology*." 1st edn Proceedings of WABE International Symposium on Cement and Concrete, Montreal, Canada, 2015.

Christopher, M.G. (1992). Logistics and supply chain management. London: Pitman Publishing.

Christopher, M. (2000). *The agile supply chain – competing in volatile markets*. Industrial Marketing Management, 29(1), 37-44.

Christopher, M. (2005), 'Logistics and supply chain management: Creating value networks', London, UK: Prentice Hall.

Choate.T.W (2015), "*Energy and emission reduction opportunities for the cement industry, industrial technologies program*. 1st edn U.S department of energy," Energy Efficiency and Renewable Energy, 2003.

Choate.T.W (2015), "*Energy and emission reduction opportunities for the cement industry, industrial technologies program.* 2nd edn U.S department of energy," Energy Efficiency and Renewable Energy, vol. 14, pp. 24-29, 2003.

Crainic, T.G, Gendreau, M, and Dejax, P. (1993). *Dynamic and stochastic models for the allocation of empty containers.* Operations Research, 41, 102-126.

Darnall, N, Jolley, G. J, and Handfield, R. (2008*). Environmental management systems and green supply chain management: Complements for sustainability?* Business Strategy and Environment, 17(1), 30-45.

De Ron, A, and Penev, K. (1995). *Disassembly and recycling of electronic consumer products:* An overview. Tec novation, 15, 407-421.

Dheeraj, N and Vishal, N. (2012), 'An overview of green supply chain management in India', Research Journal of Recent Studies, 1, 77-82.

Diab, SM, Bourini, FAA and Rumman, AHA. (2015), 'The impact of green supply chain management practices on organizational performance', Journal of Management and Sustainability, 5, 149— 157.

Dissanayake, K. (2018), *Use of Cement Sand Admixtures to Produce High Strength Soil Bricks for Low Cost Housing Projects*, Department of Earth Resources Engineering, Moratuwa, Sri Lanka.

Douglas, P.L (2016), 2nd edition "*Analysis and optimization of carbon dioxide emission mitigation options in the cement industry, American"* Journal of Environmental Sciences, vol6 2015.

Dowlatshahi, S. (2000). *Developing a theory of reverse logistics. Interfaces*, 30, 143-155.

Engin, T, and Ari, V, "*Energy auditing and recovery for dry type cement rotary kiln systems - a case study*," Energy Convers. Manage, vol. 46, no. 4, pp. 551-562, 2005.

El-Nafaty, A, "*Energy audit and conservation opportunities for pyro-processing unit of a typical dry process cement plant*," Energy, vol. 35, no. 3, pp. 1237-1243, 2010.

Elloumi, F. (2004). Value chain analysis: A strategic approach to online learning. Athabasca University. Ensign, P.C. (2001). Value chain analysis and competitive advantage. Journal of General Management, 27(1), 18- 42. Ernst, and Young. (2014). India-Online Retailing.

Fearne, A., Soosay, C., Stringer, R., Umberger, W., Dent, B., Camilleri, C., Henderson, D., and Mugford, A. (2009).

Fiksel, J. (1996). *Design for environment: Creating eco-efficient products and processes*. New York: McGraw-Hill.

Gabriel, E. (2006). Value chain for service: A new dimension of Porter's value chain. IMS International Journal, 34.

Gaitonde, U. (2018), "*Energy balance and cogeneration for a cement plant,*" Appl Therm Eng., vol. 22, Ari.V (2016), "*Energy auditing and recovery for dry type cement rotary kiln systems - a case study*," Energy Convers. Manage, vol. 46, no. 4, pp. 551-562, 2005.

Garrison, R.H., Noreen, E.W., Brewer, P.C., and McGowan, A. (2010). Managerial accounting. Issues in Accounting Education, 25(4), 792-793.

Gartner E. M. and Macphee, D. E. "*A physico-chemical basis for novel cementitious binders*," Cement Concrete Res., vol. 41, no. 7, pp. 736-749, 2011.

Gatenby, D.A and Foo, G (1990) *Design for X (DFX): Key to competitive, profitable products*. AT&T Technical Journal. 69: 2-15.

Gibson, B.J, Mentzer, J.T and Cook, R.L. (2005), 'Supply chain management: the pursuit of a consensus definition'. Journal of Business Logistics, 26, 17-25.

Giovanni, D. P., and Vinzi, E. V. (2012), Covariance versus component based estimations of performance in Green Supply Chain Management. International Journal of Production Economics, 135(2), 907-916. doi:10.1016/j.ijpe.2011.11.001

G. Kabir, A. I. Abubakar, and U. A. El-Nafaty, *"Energy audit and conservation opportunities for pyro-processing unit of a typical dry process cement plant*," Energy, vol. 35, no. 3, pp. 1237-1243, 2010.

GNR (Getting the Numbers Right), "*Cement industry energy and CO2 performance, world business council for sustainable development*," The Cement Sustainability Initiative (CSI), 2009.

Guide, V. D. R., Jayaraman, V, and Linton, J. D. (2003). *Building contingency planning for close-loop supply chains with product recovery*. Journal of Operations Management, 21, 259-279.

Guide, V. D. R., and Srivastava, R. (1998). *Inventory buffers in recoverable manufacturing. Journal of Operations Management*, 16, 551-568.

Gouda, G.R, "*Cement raw materials and their effect on fuel consumption,"* Rock Products, Chicago, vol. 80, no. 10, pp. 60-64, 1977.

Green, K, Zelbst, P, Meacham, J and Bhadauria, V. (2012), 'Green supply chain management practices: impact on performance, Supply Chain Management'. An International Journal, 17, 1-44.

Gungor, A, and Gupta, S. M. (1999). *Issues in environmentally conscious manufacturing and product recovery:* A survey. Computers and Industrial Engineering, 36, 811-853.

Gupta, S. (2018). Retailing-A step towards progress. International Journal of Scientific Research, 7(1).

Hair, J. F, Black, W. C, Babin, B. J and Anderson, R. E. (2010), 'Multivariate data analysis: A global perspective' (7th Ed.). London: Pearson.

Harland, C. M. (1996). *Supply chain management: Relationships, chains and networks*. British Journal of Management, Pg. 256.

Harland, C. M. (2016). *Supply chain management: Relationships, chains and networks.* British Journal of Management, 7, S63-S80.

Hasan, M. (2013), 'Sustainable supply chain management practices and operational performance', American Journal of Industrial ad Business Management, 3, 42-48.

Haslenda, H. (2015), "*Technical cement process simulation and environmental advantages of alternative fuels utilization*," UMIES conference, University of Malaya, Kuala Lumpur, Malaysia, vol. 29, pp. 12-14, July 2011.

Hegde, S. (2015). Entrepreneurial opportunities for e-commerce in the retail sector in India.

Hines, T. (2004), 'Supply chain strategies: Customer driven and customer focused. Oxford: Elsevier', the international Entrepreneurship and Management Journal, 1, 519-537.

Horngren, C., Dater, M., &Rajan, M. (2012). Cost accounting: A managerial Emphasis. Person Education Limited, England.

Hervani, A, Helms, M and Sarkis, J. (2005), 'Performance measurement for green supply chain management Benchmarking', An International Journal, 12, 330-353.

Huang, X, Tan, B. L and Ding, X. (2012), 'Green supply chain management practices: An investigation of manufacturing SMEs in China', International journal of Technology Management and Sustainable Development, 11, 139- 153.

IEA (International Energy Agency) statistics (2010). *CO2 emissions from fuel combustion highlights*. 1st edn [Online]. Available: http://www.iea.org/co2highlights.

IEA (International Energy Agency) statistics (2012). *CO2 emissions from fuel combustion highlights*. 2nd edn [Online]. Available: http://www.iea.org/co2highlights.

Inkpen, A., and Ramaswamy, K. (2017). Breaking up global value chains: Evidence from the global oil and gas industry. Advances in International Management, 30, 55-88.

Jayaraman, V, and Luo, Y. (2007). *Creating competitive advantage through new value creation: A reverse logistics perspective.* Academy of Management Perspective, 21(2), 56-73.

Jepsen, O. L, and Christensen, K. P, "*Improving fuel consumption and emissions by means of modern cooler, cyclone and calciner technology*," 1st edn Proceedings of WABE International Symposium on Cement and Concrete, Montreal, Canada, 2015.

Jepsen, O. L, and Christensen, K. P, "*Improving fuel consumption and emissions by means of modern cooler, cyclone and calciner technology*," 2nd edn Proceedings of WABE International Symposium on Cement and Concrete, Montreal, Canada, pp 2018.

Journal of Science and Research, 3, 2462- 2466. Remenyi, D. (2002), 'Research strategies– beyond the differences', Electronic Journal of Business Research Methods, 1, 38-41.

Kabir, G, Abubakar, A.I and El-Nafaty, U.A, "*Energy audit and conservation opportunities for pyro-processing unit of a typical dry process cement plant*," Energy, vol. 35, no. 3, pp. 1237-1243, 2010.

Kahreh, M. S., Ahmadi, H., and Hashemi, A. (2011). Achieving competitive advantage through empowering employees: An empirical study. Far East Journal of Psychology and Business, 3(2), 26-37.

Kalhara, W.M.K. (2018), *Sri Lanka's cement manufacturing and bricks making industries and environment*, University of Colombo.

Karakoç, H. (2006) *"Mathematical modelling of heat recovery from a rotary kiln*," Appl Therm Eng., vol. 30, pp. 817-825, 2010.

Khurana, S, Banerjee, R, and Gaitonde, U, "*Energy balance and cogeneration for a cement plant,*" Appl Therm Eng., vol. 22, no. 5, pp. 485-494, 2002.

Knoke, D. (2018). Changing organizations: Business networks in the new political economy. Routledge.

Kotabe, M., and Kothari, T. (2016). Emerging market multinational companies' evolutionary paths to building a competitive advantage from emerging markets to developed countries. Journal of World Business, 51(5), 729-743.

Kumar, R and Chandrakar, R. (2012), 'Overview of green supply chain management: operation and environmental impact at different stages of the supply chain', International Journal of Engineering and Advanced Technology, 1, 1-6.

Lambert, D.M and Cooper, M.C. (2000), 'Issues in supply chain management', Industrial Marketing Management, 29, 65–83.

Laosirihongthong, T, Adebanjo, D and Tan, KC. (2013), 'Green supply chain management practices and performance', Industrial Management and Data Systems, 113, 1088 -1109.

Li, S, Nathan, BR, Ragu-nathan, TS and Rao, S.S. (2004), 'The impact of supply chain management practices on competitive advantage and organizational performance', The International Journal of Management Science, 34, 107- 124.

Lin, CY and Ho, YH. (2011), 'Determinants of green practice adaption for logistics companies in China', Journal of Business Ethics, 98, 67 -83.

Machee, G.E. (2015), "*A physico-chemical basis for novel cementitious binders,*" Cement Concrete Res., vol. 41, no. 7, pp. 736-749, 2011.

Malhotra, NK. and Dash S. (2011), "Marketing Research: An applied Orientation', 6 th ed. Pearson Education. Malhotra, NK. and Peterson, M. (Eds.). (2006), Basic marketing research, (2nd ed.),

Mcdonald, M. (2016). Strategic marketing planning: Theory and practice. Journal of Marketing Management, 12(1), 4-27.

Miguel, PLDS and Brito, LAL. (2011), 'Supply chain management measurement and its influence on operational performance', Journal of Operations and Supply Chain Management, 4, 56-70

Mitra, S and Datta, PP. (2014), 'Adoption of green supply chain management practices and their impact on performance': an exploratory study of Indian manufacturing firms, International Journal of Production Research, 52, 2085- 2107

Muma, BO, Nyaoga, RB, Matwere, RB and Nyambega, E. (2014), 'Green supply chain management and environmental performance among tea processing firms in Kericho County Kenya, International Journal of Economics', Finance and Management Sciences, 2, 270 - 276.

Managing Value and Supply Chains, 3, 01-18. Shultz, C.J. II and Holbrook, M.B. (1999), 'Marketing and tragedy of the commons: a synthesis, commentary and analysis for action', Journal of Public.

Nia.Z. (2017): *Cement and its effect to the environment* a case study in Sri Lanka, University of Moratuwa, 2019.

Oliver, R, and Webber, W. (1982), Supply-chain management: Logistics catches up with strategy.

Onyango, MB, Nyaoga, RB, Matwere, RB and Onyango, JO. (2014), 'Green supply chain management and economic performance: A review of tea processing firms in Kericho and Bomet Countries, Kenya', International.

Operations and Production Management, 26(7), 754-74 Toyin, AI. (2012), 'Supply chain management (SCM) practices in Nigeria today: impact on SCM performance', European Journal of Business and Social.

Palandeng, D.I., Kindangen, P., Timbel, A., and Massie, J. (2018). Influence analysis of supply chain management and supply chain flexibility to competitive advantage and impact on company performance of fish processing in Bitung city. Journal of Research in Business, Economics and Management, 10(1), 1783-1802.

Pearson Education. Melnyk, S.A, Sroufe, R.P and Calantone, R. (2003), 'Assessing the impact of environmental management systems on corporate and environmental performance'. Journal of Operations Management, 21, 329–351.

Policy and Marketing, 18, 218-29 Storey, J, Emberson, C, Godsell, J and Harrison, A. (2006), 'Supply chain management: theory, practice and future challenges', International Journal of Sciences, 1, 107 – 115 Vachon, S and Klassen, R. (2007),

Porter, M. (2008). The five competitive forces that shape strategy. Harvard Business Review, 86(1), 78-93.

Porter, M. (2012). Strategy and the new competitive advantage: Creating share value. Harvard Business School, Boston.

Porter, M. E. (1985). Competitive advantage: Creating and sustaining superior performance. New York: Free Press, 43, 214.

Raad, S.(2015), "*Techno-Economical and Environmental Study of Utilizing Alternative Fuel and Waste Heat Reuse in a Cement Plant,*" Energy Science and Technology, vol. 2, no. 1, pp. 25-34, 2011.

Rao, P and Holt, D. (2005), 'Do green supply chains lead to competitiveness and economic performance?', International Journal of Operations and Production Management, 25(9 and 10), 898-916.

Robbins, S., and Coulter, M. (2009). Foundations of Planning. Management.

Rosy, M. (2016). Make in India: Prospects and challenges. International Journal of Business Quantitative Economics and Applied Management Research, 2(8), 60-75.

Sarkis, J., and Dou, Y. (2017). Green supply chain management: A concise introduction. Routledge.

Shank, J., and Govindarajan, V. (2004). Strategic cost management: The value chain perspective.

Shammakh, M.B, Caruso, H, Elkamel, A, Croiset, E. and Douglas, P.L, "*Analysis and optimization of carbon dioxide emission mitigation options in the cement industry, American."* 1st edn Journal of Environmental Sciences, vol. 5 2010.

Schneider, M, Romer, M, Tschudin, M, and Bolio, H, "*Sustainable cement production--present and future,"* Cement Concrete Res., vol. 35, no. 8, pp. 2015.

Schneider, M, Romer, M, Tschudin, M, and Bolio, H, "*Sustainable cement production--present and future,*" Cement Concrete Res., vol. 41, no. 2017.

Schneider, M. (2015), "*Sustainable cement production--present and future,*" Cement Concrete Res., vol. 41, no. 2017.

Schmitz, H. (2005). Value chain analysis for policy makers and practitioners. International Labor Organization.

Shammakh, M. B, Caruso, H, Elkamel, A, Croiset, E, and Douglas, P.L, "*Analysis and optimization of carbon dioxide emission mitigation options in the cement industry, American."* 2nd edn Journal of Environmental Sciences, vol6 2015.

Sögüt, Z, Oktay, Z and Karakoç, H, *"Mathematical modelling of heat recovery from a rotary kiln*," Appl Therm Eng., vol. 30, pp. 817-825, 2010.

Stonehouse, G., and Snowdon, B. (2007). Competitive advantage revisited: Michael Porter on strategy and competitiveness. Journal of Management Inquiry, 16(3), 256-273.

Sustainable value chain analysis: A case study of South Australian wine. Government of South Australia, Primary Industries and Resource SA.

Thompson, A., Gamble, J., and Strickland, J. (2005). Strategy: Winning in the market place. New York: The McGraw-Hill Companies.

Transportation Research Part E: Logistics and Transportation Review, 47, 850-871. doi:850-871. 10.1016/j.tre.201.

Vyas, A., and Gupta, S. (2017). Challenges assessment for the e-commerce industry in India: A review (With Special Reference to Flipkart V/S Snapdeal). Journal of Global Information Management (JGIM), 25(4), 16-31.

Walsh, C, Thornley, P. (2018) "Barriers to improving energy efficiency within the process industries with a focus on low grade heat utilization," J Clean Prod., vol. 23, no. 1, pp. 138-146, 2012.

Watter, H.D, *Cement Data Book,* (2017) (2nd edn), Macdonald and Evans, London.

Sekaran, U and Bougie, M. (2009), Research methods for business: A skill building approach, UK: John Wiley and Sons.

Seman, NAA, Zakuran, N, Jusof, A and Shoki, M. (2012), 'Green supply chain management: a review and research direction', International Journal of

'Supply Chain Management and environmental technology: the role of integration', International Journal of production research, 45, 401-425.

Walker, H, Sisto L.D &McBain, D. (2008), 'Drivers and barriers to environmental supply chain management practices: Lessons from the public and private sectors', Journal of Purchasing and Supply Management 14, 69–85.

Wu, Z and Pagell, M. (2011), 'Balancing priorities: Decision-making in sustainable supply chain management', Journal of Operations Management, 29, 577-590.

Xiao, X. (2006), 'Green supply chain management in the UK and China construction industry', (Unpublished Masters Dissertation). University of East Anglia.

Yang, CS. (2013), 'Research on the performance measurement of green supply chain management in China', Proceedings of the Eastern Asia Society forTransportation Studies, 4, 101

Zahedi. G (2016). "*A novel design for green and economical cement manufacturing,"* J Clean Prod., vol. 22, no. 1, pp. 60-66, 2012.

Zhu, Q &Sarkis, J. (2004), 'Relationships between operational practices and performance amongst early adopters of green supply chain management practices in Chinese manufacturing enterprises' Journal of Operations Management, 22, 265- 289.

Zhu, Q, Sarkis, J and Lai, KH. (2012), 'Examining the effects of green supply chain management practices and their mediations on performance improvements', International Journal of Production Research, 50, 1337-1394.

Zhu, Q, Sarkis, J and Lai, KH. (2008), 'Confirmation of a measurement model for green supply chain management practices implementation' International Journal of Production Economics, 111, 261-273.

Zhu, Q, Sarkis, J &Geng Y. (2005), 'Green supply chain management in China: pressures, practices and performance', International Journal of Operations and Production Management, 25, 449-468

Zhu, Q, &Sarkis, J. (2006), 'An inter-sectorial comparison of green supply chainmanagement in China: Drivers and practices', Journal of Cleaner Production 14, 472- 486.

Zhu, Q., and Sarkis, J. (2007), The moderating effects of institutional pressures on emergent green supply chain practices and performance. International Journalof Production Research, 45(19), 4333-4355.

Bibliography

Adamik, A.; Nowicki, M. (2019). Pathologies and paradoxes of co-creation: A contribution to the discussion aboutcorporate social responsibility in building a competitive advantage in the age of industry 4.0. Sustainability2019, 11, 4954.

Ahi, P., and Searcy, C. (2013). A comparative literature analysis of definitions for green and sustainable supply chain management. Journal of Cleaner Production, 52, 329-341.

Ali, H. M. G. (2016). The Role of Retailers in Promoting the Marketing of Dairy Products in Khartoum State-Sudan (Doctoral dissertation, University of Khartoum).

Allenby, S, Richards, D. (1994). *The greening of industrial eco-systems.* Washington: National Academic Press.

Arena, U, Mastellone, M. L, and Perugini, F. (2003). *The environmental performance of alternative solid waste management options:* A lifecycle assessment study. Chemical Engineering Journal, 96, 207-222.

Ashley, S. (1993). *Designing for the environment. Mechanical Engineering*, 115(3).

Atkinson, A.B. (2016). Ekonomika Nerovnosti; Fragment: Prague, Czech Republic, 2016.

Banbury, J.G. (1975). *Distribution – the final link in the electricity–supply chain.* Electrics and Power Journal of the Institution of Electrical Engineers, 21(13), 773-775.

Barros, A. I, Dekker, R, and Scholten, V. (1998). *A two-level network for recycling sand: A case study. European Journal of Operational Research*, 110, 199-214. Beamon, B. (1999). Designing the green supply chain. Logistics Information Management, 12(4), 332-342.

Barlett, A.; Ghoshal, S. (2003). What is a global manager? Harv. Bus. Rev. 2003, 81, 101–108.

Bedeley, R.T.; Ghoshal, T.; Iyer, L.S.; Bhadury, J. (2018). Business analytics and organizational value chains: A relational mapping. J. Comput. Inf. Syst. 58, 151–161.

Benhelal, E, Zahedi, G, and Haslenda, H (2012). "A *novel design for green and economical cement manufacturing,*" J Clean Prod., vol. 22, no. 1, pp. 60-66.

Benhelal, E and Haslenda, H. (2011). "*Technical cement process simulation and environmental advantages of alternative fuels utilization,"* UMIES conference, University of Malaya, Kuala Lumpur, Malaysia, vol. 29, pp. 12-14.

Benhelal, E, Azin, R and Raad, S. (2011). "*Techno-Economical and Environmental Study of Utilizing Alternative Fuel and Waste Heat Reuse in a Cement Plant*," Energy Science and Technology, vol. 2, no. 1, pp. 25-34.

Bocken, N.M.P.; Rana, P.; Short, S.W.(2015). Value mapping for sustainable business thinking. J. Ind. Prod. Eng.2015, 32, 67–81.

Borshchevska, Y. (2016). Putting a competitive advantage at stake? Energiewende in the discursive practices of German industrial actors. J. Int. Stud. 2016, 9, 99–123.

Brass, B, and McIntosh, M. W. (1999). *Product, process, and organizational design for remanufacture - an overview of research.* Robotics and Computer-Integrated Manufacturing, 15, 167-178.

Bryman, A. and Bell, E. (2015). Business research methods. Oxford University Press, USA.

Cairncross, F. (1985). *Costing the earth.* Boston: Harvard Business School Press.

Casadesus-Masanell, R.; Ricart, J.E. (2010). From strategy to business models and onto tactics. Long Range Plan. 2010, 43, 195–215.

Carter, C.R, and Ellram, L.M. (1988). Reverse logistics: A *review of the literature and framework for future investigation. Journal of Business Logistics,* 19, 85-102.

Chen. C, Habert. G (2016), "*Environmental impact of cement production: detail of the different processes and cement plant variability evaluation*," J Clean Prod., vol. 18, no. 5, pp. 478-485, 2010.

Chenhall, R.H. (2002). Integrative strategic performance measurement systems, strategic alignment of manufacturing, learning and strategic outcomes: An exploratory study. Account. Organ. Soc. 2005, 30, 395–422.

Chiaromonte, F.; Cook, R.D.; Li, B. (2002). Sufficient dimension reduction in regressions with categorical predictors.Ann. Stat. 2002, 30, 475–497.

Christopher, M.G. (1992). *Logistics and supply chain management. London*: Pitman Publishing.

Christopher, M. (2000). *The agile supply chain – competing in volatile markets*. Industrial Marketing Management, 29(1), 37-44.

Choate.T.W (2015), "*Energy and emission reduction opportunities for the cement industry, industrial technologies program.* 2nd edn U.S department of energy," Energy Efficiency and Renewable Energy, vol. 14, pp. 24-29, 2003.

Cook, R.D.; Lee, H. (1999). Dimension reduction in binary response regression. J. Am. Stat. Assoc. 1999, 94, 1187–1200.

Crainic, T.G, Gendreau, M, and Dejax, P. (1993). *Dynamic and stochastic models for the allocation of empty containers.* Operations Research, 41, 102-126.

Dagnino, G.B.; King, D.R.; Tienari, J. (2017). Strategic management of dynamic growth. Long Range Plan. 50, 427–430.

Darnall, N, Jolley, G. J, and Handfield, R. (2008*). Environmental management systems and green supply chain management: Complements for sustainability?* Business Strategy and Environment, 17(1), 30-45.

Demir, R.; Wennberg, K.; McKelvie, K. (2017). The strategic management of high-growth firms: A review and theoretical conceptualization. Long Range Plan. 2017, 50, 431–456.

De Ron, A, and Penev, K. (1995). *Disassembly and recycling of electronic consumer products:* An overview. Tec novation, 15, 407-421.

Dowlatshahi, S. (2000). *Developing a theory of reverse logistics. Interfaces,* 30, 143-155.

Downey, J.; Strategic Analysis Tools. CIMA Global. (2007). Available online: http://www.cimaglobal.com/Documents/ImportedDocuments/cid_tg_strategic_analysis_tools_nov07.pdf.pdf (accessedon 1 January 2018).

Engin, T, and Ari, V. (2005). "*Energy auditing and recovery for dry type cement rotary kiln systems -a case study*," Energy Convers. Manage, vol. 46, no. 4, pp. 551-562, 2005.

Fawi, N. M., and Osman, M. A. A. (2016). Assessment Of Business Management Disciplines Implemented In Small Holder Dairy Farms In Khartoum State.

Feller, A.; Shunk, D.; Callarman, T. (2006). Value Chains versus Supply Chains; BPTrends: Newton, MA, USA, 2006; pp. 1–7.

Fernandez-Stark, K., Bamber, P., and Gereffi, G. (2014). Global value chains in Latin America: A development perspective for upgrading. Global value chains and world trade:

Prospects and challenges for Latin America. Santiago: ECLAC, 2014. LC/G. 2617-P. p. 79-106.

Fiksel, J. (1996). *Design for environment: Creating eco-efficient products and processes*. New York: McGraw-Hill.

Flanagan, D.J.; Lepisto, D.A.; Ofstein, L.F. (2018). Coopetition among nascent craft breweries: A value chain analysis.J. Small Bus. Enterp. Dev. 2018, 25, 2–16.

Frost, F.A. (2003). The use of strategic tools by small and medium-sized enterprises: An Australasian study. Strateg. Chang. 2003, 12, 49–62.

Gatenby, D.A and Foo, G (1990). Design for X (DFX): *Key to competitive, profitable products*. AT&T Technical Journal. 69: 2-15.

Gavur, B.; Delina, R. (2010). Approaches to measuring and managing performance and their application possibilities in enterprises. Ekon. Manag. Podn. 2010, 8, 5–19.

Gouda, G.R. (1977). "*Cement raw materials and their effect on fuel consumption,"* Rock Products, Chicago, vol. 80, no. 10, pp. 60-64, 1977.

Guide, V. D. R., Jayaraman, V, and Linton, J. D. (2003). *Building contingency planning for close-loop supply chains with product recovery*. Journal of Operations Management, 21, 259-279.

Guide, V. D. R., and Srivastava, R. (1998). *Inventory buffers in recoverable manufacturing. Journal of Operations Management*, 16, 551-568.

Gungor, A, and Gupta, S. M. (1999). *Issues in environmentally conscious manufacturing and product recovery:* A survey. Computers and Industrial Engineering, 36, 811-853.

Gartner E. M. and Macphee, D. E. (2011). "*A physico-chemical basis for novel cementitious binders*," Cement Concrete Res., vol. 41, no. 7, pp. 736-749, 2011.

Gunn, R.; Williams, W. (2007). Strategic tools: An empirical investigation into strategy in practice in the UK. Strateg. Chang. J. 2007, 16, 201–216.

Gupta, S.; Palsule-Desai, O.D. (2011). Sustainable supply chain management: Review and research opportunities.IIMB Manag. Rev. 2011, 23, 234–245.

Harford, T. (2005). The Undercover Economist: Exposing Why the Rich are Rich, the Poor are Poor—and why you CanNever Buy a Decent Used Car! Oxford University Press: New York, NY, USA, 2005.

Hair, J.F.(2015). Essentials of business research methods. ME Sharpe.

Harland, C. M, (2016). *Supply chain management: Relationships, chains and networks*. British Journal of Management, 7, S63-S80.

Harris, P.R. (2002). European challenge: Developing global organizations. Eur. Bus. Rev. 2002, 14, 416–425.

Hill, C.W.L. Jones, G.R. (2009). Essentials of Strategic Management, 2nd ed.; South-Western Cengage Learning: Mason, OH, USA.

Hitt, M.A.; Miller, C.C.; Colella, A. (2009). Organizational Behavior: A Strategic Approach; John Wiley and Sons: Hoboken, NJ, USA.

Ibrahim, A. M., Ismail, A. A., Angara, T. E. E., and Osman, M. O. (2014). Area-wide Detection of AntiToxoplasma gondii Antibodies in Dairy Animals from the Khartoum State, Sudan. Journal of life sciences.

IEA (International Energy Agency) statistics (2010). *CO2 emissions from fuel combustion highlights*. 1st edn

IEA (International Energy Agency) statistics (2012). *CO2 emissions from fuel combustion highlights*. 2nd edn

Jayaraman, V, and Luo, Y. (2007). *Creating competitive advantage through new value creation: A reverse logistics perspective.* Academy of Management Perspective, 21(2), 56-73.

Jepsen, O. L, and Christensen, K. P.(1998). "*Improving fuel consumption and emissions by means of modern cooler, cyclone and calciner technology*," Proceedings of WABE International Symposium on Cement and Concrete, Montreal, Canada, pp.5-15.

Jenkins, D. (2012). Measuring Performance: A Toolkit of Traditional and Alternative Methods; Gower Pub: Burlington, VT, USA.

Kabir, G, Abubakar, A.I and El-Nafaty, U.A. (2010). "*Energy audit and conservation opportunities for pyro-processing unit of a typical dry process cement plant*," Energy, vol. 35, no. 3, pp. 1237-1243.

Kennerley, M.; Neely, A. A (2002). Framework of the factors affecting the evolution of performance measurementsystems. Int. J. Oper. Prod. Manag. 22, 1222–1245.

Khurana, S, Banerjee, R, and Gaitonde, U. (2002). "*Energy balance and cogeneration for a cement plant,*" Appl Therm Eng., vol. 22, no. 5, pp. 485-494.

Knott, P. A. (2006). Typology of strategy tool applications. Manag. Decis. 2006, 44, 1090–1105.

Koc, T.; Bozdag, E. (2017). Measuring the degree of novelty of innovation based on Porter's value chain approach.Eur. J. Oper. Res., 257, 559–567.

Krykavskyy, E.V.; Patora-Wysocka, Z. (2015). Porter's value chain (construction, deconstruction, reconstruction) and values management. Mark. Manag. Innov. , 6, 121–133.

Kumar, R., and Mohan, A. (2014). Antecedent of Dairy Supply Chain Management Practices: A Conceptual Framework. Journal of Supply Chain Management Systems, 3(1).

Magretta, J. (2012). Michael Porter Jasnˇe a Srozumitelnˇe; Management Press: Prague, Czech Republic.

Mallya, T. Základy (2007). Strategického Rˇízení a Rozhodování; Grada Publishing: Prague, Czech Republic.

McCullagh, P.; Nelder, J.A. (1989). Generalized Linear Models, 2nd ed.; Chapman and Hall/CRC: Boca Raton, FL, USA.

McGuffog, T.; Wadsley, N. (1999). The general principles of value chain management. Supply Chain Manag. Int. J., 4, 218–225.

McPhee, W.; Wheeler, D. (2006). Making the case for the added-value chain. Strategy Leadersh. , 34, 39–46.

Meskendahl, S. (2010).The influence of business strategy on project portfolio management and its success—A conceptual framework. Int. J. Proj. Manag. 2010, 28, 807–817.

Murray, A, and Price, L. (2008). *"Use of Alternative Fuels in Cement Manufacture: Analysis of Fuel Characteristics and Feasibility for Use in the Chinese Cement Sector,"* Energy and Resources Group and Environmental Energy Technologies Division, UC Berkeley, U.S.A.

Nagy, J.; Olah, J.; Erdei, E.; Mate, D.; Popp, J. (2008).The Role and impact of industry 4.0 and the internet of thingson the business strategy of the value chain-the case of Hungary, 10, 3491.

Mohammed, K. (2015). Comparative efficacy and economic impact of some commonly used antibiotics and anthelmintics in the veterinary field in Sudan (Doctoral dissertation, UOFK).

Mohammed, R. R. (2016). Evaluation of Farms Management as A method of Control of Bovine Mastitis in Sudan.

Nia.Z. (2017): *Cement and its effect to the environment* a case study in Sri Lanka, University of Moratuwa, 2019.

Prakash, G. (2015). A Framework for Sustainable Food Supply Chain: Reflections from the Indian Dairy Producers. In Toward Sustainable Operations of Supply Chain and Logistics Systems (pp. 161- 182). Springer International Publishing.

Porter, M. Competitive Advantage (1985). Free Press: New York, NY, USA, 1985.

Porter, M. (2015). Shared value and strategy. In Proceedings of the Shared Value Leadership Summit, FSG, New York, NY, USA, 12 May 2015.

Porter, M.E. (2008). The five competitive forces that shape strategy. Harv. Bus. Rev. 2008, 86, 78–93.

Robbins, S.P. (2004). Coulter, M. Management; Grada Publishing: Prague, Czech Republic, 2004.

Rodrigues, M.; Franco, M. (2019). The corporate sustainability strategy in organisations: A systematic review andfuture directions. 11, 6214.

Schmeisser, B. (2013). A systematic review of literature on off shoring of value chain activities. Journal of International Management, 19(4), 390- 406.

Schneider, M, Romer, M, Tschudin, M, and Bolio, H. (2011). "*Sustainable cement production--present and future*," Cement Concrete Res., vol. 41, no.7, PP. 442-650.

Simatupang, T.M.; Piboonrungroj, P.; Williams, S.J. (2017). The emergence of value chain thinking.Int. J. Value Chain Manag, 8, 40–57.

Sögüt, Z, Oktay, Z and Karakoç, H. (2010). *"Mathematical modelling of heat recovery from a rotary kiln*," Appl Therm Eng., vol. 30, pp. 817-825.

Shammakh, M.B, Caruso, H, Elkamel, A, Croiset, E. and Douglas, P.L. (2010). "*Analysis and optimization of carbon dioxide emission mitigation options in the cement industry, American."* 1st edn Journal of Environmental Sciences, vol. 5.

Shammakh, M. B, Caruso, H, Elkamel, A, Croiset, E, and Douglas, P.L. (2015). "*Analysis and optimization of carbon dioxide emission mitigation options in the cement industry, American."* 2nd edn Journal of Environmental Sciences, vol.6.

Singh, G.; Gaur, L.; Agarwal, M. (2017). Factors influencing the digital business strategy. Pertanika J. Soc. Sci. Humanit.

Shpak, N.O.; Stanasiuk, N.S.; Hlushko, O.V.; Sroka, W. (2018). Assessment of the social and labor components of industrial potential in the context of corporate social responsibility. Pol. J. Manag, 17, 209–220.

Szczepa ´nska-Woszczyna, K.; Kurowska-Pysz, J. (2016). Sustainable business development through leadership inSMEs. Eng. Manag. Prod. Serv. 2016, 8, 57–69.

Straková, J. (2017). Strategic analysis methods and their influence on stability and development of small andmedium-sized enterprises in the Czech Republic. Stud. Comer. Bratisl. 2017, 10, 196–214.

Straková, J.; Pártlová, P.; Dobroviˇc, J.; Váchal, J. (2018). Situational analysis and its role in the process of strategicbusiness management. Pol. J. Manag. Stud. 2018, 18, 353–364.

Stadtler, H. (2015). Supply chain management: An overview. In Supply chain management and advanced planning (pp. 3-28). Springer Berlin Heidelberg.

Timmer, M. P., Erumban, A. A., Los, B., Stehrer, R., and de Vries, G. J. (2014). Slicing up global value chains. The Journal of Economic Perspectives, 28(2), 99-118

Wang, G. (2007). Research on business environment of construction supervison in China. In Proceedings of theCRIOCM 2007 International Research Symposium on Advancement of Construction Management and RealEstate, Sydney, Australia, 8–13 August 2007; pp. 649–659.

Walsh, C, Thornley, P. (2018) "Barriers to improving energy efficiency within the process industries with a focus on low grade heat utilization," J Clean Prod., vol. 23, no. 1, pp. 138-146, 2012.

Watter, H.D. (2017). *Cement Data Book*, 2nd edn, Macdonald and Evans, London

Wirtz, B.W.; Pistoia, A.; Ullrich, S. (2017). Business models: Origin, development and future research perspectives. Long Range Plan, 49, 36–54. , 25, 1489–1500.

Vochozka, M.; Jelínek, J.; Váchal, J.; Straková, J.; Stehel, V. (2017). Využití Neuronových Sítí P˘ri Komplexním HodnoceníPodnik ˚u; C.H. Beck: Prague, Czech Republic.

Zhang, D. (2017). Porter's five forces analysis and value chain analysis of AUX Air Conditioning Co., Ltd.In Proceedings of the 3RD International Conference on Social Science and Technology Education (ICSSTE2017), Wuhan, China, 8–9 April 2017; pp. 350–354.

Annexure

Adaptation of Green Value Chain Strategy in Industry Sustainability of the Cement Manufacturing Sector of Sri Lanka.

PART I– Profile Information about the Respondents

1.	Gender	Male	□		Female		□		
2.	Age (years)	18-25		26-35		36-45		46 above	
3.	Education	High School		Degree		Professional		Post Graduate	
3.	Career Level In the company	Top Mgt		Middle Mgt		Senior Executives		Executives	
4.	Specialized Field	Operations and Technology		Supply		Business Development		Finance & Administration	
5	Experience (Present Company)	1-3 Years		3-6 Years		6-9 Years		9 above Years	
6	Engagement on Green activities	Very High		High		Average		Less/ or Not at all	

Following statements are related to the green value creation activities, environmental innovations and how your company plans for achieving the sustainable performance out of those. Please answer the questions based on the scale provided herewith depending on your engagements and awareness on those matters.

Please indicate your answer by ticking **ONE** box from **"strongly disagree" to (1) to "strongly agree" (5) according to your most preferred brand selected above.**

PART II– Green Value Creation Adaptation

Seq.	Description	Strongly Disagree	Disagree	Neither Disagree nor Agree	Agree	Strongly Agree
7.	My company adopts Waste recycling activities	☐	☐	☐	☐	☐
8.	My company adopts environmental innovation practices within the operations	☐	☐	☐	☐	☐
9.	My company adopts methods for Lower level of emission	☐	☐	☐	☐	☐
10.	My company adopts Green operational analysis procedures in different sections	☐	☐	☐	☐	☐
11.	My company adopts Continuous green improvement procedures	☐	☐	☐	☐	☐

12.	My company adopts Green measurements procedures	☐	☐	☐	☐	☐
13	My company adopts Green objectives related procedures in different sections	☐	☐	☐	☐	☐

PART III– Sustainable Performance

Seq.	Description	Strongly Disagree	Disagree	Neither Disagree nor Agree	Agree	Strongly Agree
14.	Due to green value practices, my company is able for Reducing Energy consumption	☐	☐	☐	☐	☐
15.	Due to green value practices, my company is able for Reducing wastes	☐	☐	☐	☐	☐
16.	Due to green value practices, my company is able to meet Pollution control	☐	☐	☐	☐	☐
17	Due to green value practices, my company is able to meet Recycling measures	☐	☐	☐	☐	☐
18	Due to green value practices, my company is able to meet Clean and green operations	☐	☐	☐	☐	☐

19	Due to green value practices, my company is able to reduce cost of materials	☐	☐	☐	☐	☐
20	Due to green value practices, my company is able to obtain Product competitiveness	☐	☐	☐	☐	☐
21	Due to green value practices, my company is able to do Market expansion	☐	☐	☐	☐	☐
22	Due to green value practices, my company is able to uplift Company image amongst stakeholders	☐	☐	☐	☐	☐
23	Due to green value practices, my company is able to obtain Management improvements	☐	☐	☐	☐	☐
24	Due to green value practices, my company is able to obtain good public awareness	☐	☐	☐	☐	☐

PART IV– Environmental Innovation

Seq.	Description	Strongly Disagree	Disagree	Neither Disagree nor Agree	Agree	Strongly Agree
25	My company applies End-of-pipe pollution control technology in overall processes	☐	☐	☐	☐	☐
26.	My company applies Waste management methods in overall processes	☐	☐	☐	☐	☐
27.	My company applies Clean process-integrated technology in overall processes	☐	☐	☐	☐	☐
28	My company applies recycling methods in overall processes	☐	☐	☐	☐	☐
29	My company applies clean product methods in overall integrated functions	☐	☐	☐	☐	☐
30	My company applies clean-up technology for overall functions and activities	☐	☐	☐	☐	☐

Thank you very much for your cooperation….

PART II– Brand Love

Seq.	Description	Strongly Disagree	Disagree	Neither Disagree nor Agree	Agree	Strongly Agree
1.	Using this brand helps you to show the world who you are and gives you internal emotional benefits	☐	☐	☐	☐	☐
2.	You would spend a lot of time/money to buy the particular brand amidst other brands	☐	☐	☐	☐	☐
3.	I feel myself craving/a strong desire of wanting the particular brand	☐	☐	☐	☐	☐
4.	I have been involved with the brand in a considerable period of the past	☐	☐	☐	☐	☐
5.	I feel comfortable, emotionally satisfied when I use the brand	☐	☐	☐	☐	☐
6.	I feel that I will be committed to use this in the future	☐	☐	☐	☐	☐
7.	I will be worried if I come across a situation of not been able to have the brand	☐	☐	☐	☐	☐
8.	It is the most ideal brand and meets my expectations	☐	☐	☐	☐	☐
9.	I often think about this brand and have strong feelings towards it	☐	☐	☐	☐	☐

PART II– Brand Personality

Seq.	Description	Strongly Disagree	Disagree	Neither Disagree nor Agree	Agree	Strongly Agree
10.	The multi-sensory experience makes me feel that this brand has is reliable, successful and confident.	☐	☐	☐	☐	☐
11.	The multi-sensory experience makes me feel that this brand expresses qualities such as down-to earth, honest, cheerful and friendly.	☐	☐	☐	☐	☐
12.	The multi-sensory experience makes me feel trendy, cool, exciting when using this brand.	☐	☐	☐	☐	☐
13.	The multi-sensory experience makes me feel that I indicate qualities of sophistication and upper-class when using this brand.	☐	☐	☐	☐	☐
14.	The multi-sensory experience makes me feel that I indicate qualities of sophistication and upper-class when using this brand.	☐	☐	☐	☐	☐
15.	The multi-sensory experience makes me feel that the brand is rough and masculine in nature.	☐	☐	☐	☐	☐