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Green and low carbon matters: A systematic review of the past, today, and future on sustainability supply chain management practices among manufacturing industry

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ABSTRACT

Climate change has arisen as one of human beings' most significant threats. A higher proportion of carbon dioxide emissions are produced from developing countries as manufacturing globalization requires more and more emerging nations. The predicament between carbon reduction and fast industrial development makes firms in developing countries reluctant to take thoughtful commitment and actions in carbon dioxide emission reduction in their global manufacturing practices. Sustainability, green, and low-carbon supply chain networks research is still also in its infant stage from a theoretical perspective and requires further research and development. Therefore this research aims to address the research question: "Why and how organizations are adopting sustainable strategies in developing countries to increase sustainable supply chain management practices in the manufacturing?". In order to thoroughly analyse the literature, this paper used ATLAS.ti 9 software tools to save, identify, and assess the data for this study. We reviewed, compiled, and sorted papers from 326 publications for this article and then recognized 141 as critical to the work scope. The results reveal that the organization's current concentration is on improving internal environmental efficiency related to its mid-stream SCM activities. The introduction of environmental practices at the external level (downstream and upstream) is relatively limited, and few organizations are collaborating effectively with supply chain partners to improve their SSCM performance. The results also show that organizational performance, reputation/risk management, customer pressure, and top management support are primary motivators for organizations to embrace SSCM practices. The typology suggests that companies need to consider and recognize their key sustainability risk in the past, current, and future to have a simple organizational design to innovative management methods to handle their sustainable supply chain practices.

1. Introduction

Supply chains usually consist of various companies collaborating to satisfy market demand, e.g., vendors, distributors, logistics and transportation systems, retailers, end-users, and government regulatory authorities. Organizational emphasis has been focused over the last few decades on increasing the supply chain's efficiency by organizational effectiveness to developing supply chains that distribute products and services to consumers at a low cost as soon as possible. Outsourcing, offshoring, long-term arrangements and partnerships with very few vendors include some of the tactics implemented by businesses to decrease supply chain costs dramatically. Supply chain suppliers are now spread worldwide, contributing to multinational supply chains (Kim and Park, 2014). Supply chains have become more dynamic, intertwined, and interdependent due to this process of globalization. These supply chains are also marked by external uncertainties, such as fluctuations in the currency exchange rate, adjustments in the import tax rate, limits on exports, social and cultural problems, natural disasters, terrorism, and other problems (Ravindran and Warsing Jr, 2016). Thus, a business needs to achieve a strategic edge to handle global supply chain uncertainty and related risks. Although it is still essential for companies to manage supply chain risks, sustainability has added another dimension

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of supply chain uncertainty (Bui et al., 2020).

It is necessary to characterize supply chain risk and sustainability as two sides of a coin in the 21st century. Owing to a lack of sufficient exposure to environmental concerns at their global supply base, some significant firms have experienced reputational harm in the past. Examples include Nike's claims of 'sweatshops' in the 1970s (i.e., cheap/child labour in the Far East), Apple's claims of unsafe job policies and working conditions at Foxconn's factories in China in 2009/2010, and Ikea's allegations of child and forced labour even in the 1990s (Ravindran and Warsing, 2016). According to Liu (2015), retailer misdeeds not only have collateral impacts on the whole supply chain network by reinforcing the credibility of the main business (buyer) but may often have a direct detrimental effect on its profitability. Also, policymakers worldwide have continually faced difficulties identifying and handling the challenges involved with the global supply chain and transport networks in their regulatory role (Ravindran and Warsing, 2016). Focusing on enhancing supply chain performance alone is no longer enough in the new global business landscape for an organization to succeed and stay competitive. This is because corporate models are evolving rapidly; clients are becoming more mindful of sustainability. Environmental rules are becoming tougher, and multinational supply chains have to respond to these changes (Alkhuzaim et al., 2020).

It is also imperative that the organization organize its supply chain processes appropriately, productive, and sustainable. Sustainable supply chain management is described by Seuring and Müller (2008) as the management of content, knowledge, and capital flows, as well as collaboration between companies along the supply chain, thus taking account of priorities from all three perspectives of sustainable growth, i.e., environmental, economic, and social, extracted from consumer and stakeholder requirements. It is also documented that supply chain management consists of five interconnected problems, namely: supply chain network structure, supply relationships, choice of suppliers, distribution of supplier orders, and supply contracts.

In addition to the above factors, studies on emerging countries' issues are apparently restricted. Limited studies on comprehensive SSCM are published in Malaysia, especially in the manufacturing industry. To date, the limited research conducted in the area of SSCM were largely concerning countries such as China (Zhu and Sarkis, 2004) and (Gu et al., 2016), Germany (Wittstruck and Teuteberg, 2012), the United Kingdom (Ninlawan et al., 2012), and the United States (Green et al., 2012) and (Oelze et al., 2020). Some other factors motivated this research to concentrate on Malaysia, especially the manufacturing industry, considering the absence of a case study from developing countries (Zhu et al., 2008). About a quarter of manufacturing value-added and over 50 percent of produced exports in Malaysia belonged to the manufacturing market (MIDA, 2020). The export market often drives manufacturing production with a global orientation owing to a limited domestic market. Malaysia's manufacturing sectors have also continued to draw massive quantities of foreign direct investment since the 1970s. With the migration of multinational corporations (MNCs), SSCM-related learning among local companies has significantly improved among companies that want to advantage from assimilating into the comprehensive supply chain. However, considering the long and consistent status of the manufacturing sectors, attempts are still moderate and sluggish to integrate high-tech environments and large-scale creativity. The notion that SSCMP would contribute substantially to SCP should not, however, be taken for granted.

To sum up, the aforementioned discussion shows that the supply chain's sustainable management has become a critical concern for businesses. Academic research exploring sustainable supply chain management is typically inadequate. This topic is restricted in the manufacturing sector, especially in the manufacturing sector, which needs more research on the topic (Zhu et al., 2008). This research seeks to fill these gaps in the current information body and contribute to the sustainable supply chain management literature by discussing whether and how organizations adopt sustainable supply chain management.

The remainder of this article is formulated in the following way. Section 2 develops the practices of supply chain management, and Section 3 discusses the preferred research methodology. The literature is analysed in Sections 4 and 5 to establish the supply chain of past and current practices. Section 6 describes the modern advances in the supply chain; Sections 7 and 8 illustrate the sustainable management of the supply chain and the motivators for SSCM strategy execution. The findings are stated in Sections 9 and some discussion and management implications in conjunction with the results. Last but not least, in addition to recommending more research directions, Sections 10 and 11 discuss the study's conclusion and limitations.

2. Supply chain management practices

Studies have explored comparisons between logistics and supply chain management since the advent of the principle of supply chain management (SCM) in 1982 (Christopher and Ryals, 2014). The precise origin of the supply chain management definition is still uncertain. Still, it is related to Scott et al. (2015), who defined competitive responses in supply chain situations to demand changes. He illustrated distortions in the trends of demand stimulated by the nuances of the transition of demand from end-users to the supply chain. Besides, Fig. 2 shows how the organisation handle their supply chain in the past and today. The advent of supply chain management can also be attributed to the Total Cost method's logistics and delivery method. The philosophy of the structure, which involves an aggregated study of the constituent parts of a system to explain the behaviour of dynamic systems properly, has added to the emergence of the idea of the supply chain (Scott et al., 2015).

The systems approach and earlier ideas represented that the whole system should be the unit of analysis to maximize system efficiency; concentrating on a particular object will not enhance results, as the shortcomings inherent in the whole system will be limited (Sodenkamp et al., 2016). The Just-In-Time idea implemented in the 1980s is now known to be the predominant root of the supply chain management idea (Ellram and Cooper, 2014). Logistics is commonly correlated with supply chain management, and several scholars have made strong differences between the two. For instance, Mills and Hoeber (2013) claimed that, in principle, logistics literature recognizes fair collaboration between manufacturers, consumers, and service providers to find efficient solutions for product, transport, knowledge flows, and various transactions. On the other hand, supply chain management presumes that these actors have interpersonal and political aspects of control, confidence, confrontation, and dependence.

Consequently, it can also be stated that the management of the supply chain is more than a rename or a purely logistical feature. The unionist perception also strengthens the stock perception that supply chain management is responsible for administering eight main business processes: demand control, sourcing, flow management, consumer relations management, customer support management, order delivery, inventory creation, and marketing and returns. Moreover, the concept of logistics by the supply chain management professionals council indicates that logistics is part of supply chain management because it says, "Logistics is the supply chain phase component of which the reliable, successful flow, storage and distribution of goods, resources and related material, from its source to its destination, is being designed, enforced, and controlled.

Jüttner et al. (2010) pointed out that a specific aspect of supply chain management is that it involves separate partners to organize their value-creating activities and described supply chain management as' the management of upstream and downstream relationships with suppliers and customers to produce enhanced value at a lower cost to the supply chain in the final market place. Three viewpoints for supply chain management concepts were illustrated by Vaaland and Heide (2007). First, operational concepts are directed at handling resource transfer from end to end. This focus on logistics operations is mirrored. Secondly,

relational concepts reflect on the administration, alignment, and cooperation of supply chain relationship relations. The final viewpoint is process-oriented concepts, which rely on technological connections to control supply chain operations. Vaaland and Heide (2007) focused on the above viewpoint and claimed that all three points of view should involve supply chain administration as a whole. In short, supply chain management needs incorporation into seamless systems across all value-enhancing operations. It represents a transition from the conventional vertical hierarchical organization to a monitoring and control approach to a more processor-oriented approach that is integrative, focused upon a close partnership and cooperation between supplier customers and supply chain stakeholders (Govindan et al., 2015).

3. Methodology

3.1. Literature search

One potential method of implementing qualitative analysis to text data is illustrated by the methodology presented in this manuscript. Numerous distinct phases are defined in the planning and exploring sustainable supply chain management in version 9 of ATLAS.ti. Therefore, every phase of the appraisal process is structured around the Methods, Conclusions, and Discussion parts, helping the reader better understand how the data was analysed and follow the process's ramifications and the resulting data. A review was carried out first of all. The literature scanning allowed the authors to define the analytical structures used in the processing and analysis of the data. The research sources used for the search were Taylor and Francis, Emerald, Springer, Google Scholar and Elsevier. Simultaneously, the predominant keywords were Sustainability Supply chain management Practice, Green Sustainability, Cleaner Production, Reverse Logistics, Sustainability Practices, Low Carbon Emissions, Green Procurement, and Green Design.

Only journal articles, books, and conference proceedings were included in the analysis to ensure the academic fields' inclusion under the scrutiny of the most credible materials and publications of exceptional managerial effect (Thornhill et al., 2009). They contained only articles written in the English language. The approach outlined in this paper shows one possible way of applying qualitative research to text results. In the preparation and exploration of the past, today, and future supply chain management practice, various separate stages are described. Each stage of the evaluation phase is then organised around the sections of processes, findings, and discussion, allowing the reader to further understand how the data are evaluated and follow the process's implications and the resulting data. The 326 papers Identified were screened (Identified through database searching, 326 papers), Screening (Post Removal of Duplicates, 275 papers remain), Eligibility (Post--Abstract Review, 188 papers remain), and validated for Included (Post-Full-Text Review, 141 papers was used). Duplicates have been excluded as part of this process, eligibility has been verified from abstracts, and the complete content of outstanding papers has been checked in the context of the study issues for the final judgment regarding the past, today, and future supply chain management practice areas under examination (Shamseer et al., 2015). As per the systematic literature review protocol for this study, the 141 papers were screened and verified as valid. And the quest date for this analysis was set from 1993 to 2021.

This study proposed and validated the methodological concept produced by academic and literary contributions. In one scenario, the characteristics of the interest parameters are to be determined by descriptive analysis. This study shows what changes will benefit sustainable supply chain management in order to enhance the efficiency of the supply chain in the manufacturing industry, increase competitiveness, recognize potential technologies, recognize business risk and encourage investments in technology.

In order to achieve the aims of this study, a systematic review has been carried out to present synthesis results. Lu and Liu (2014) have previously operationalized the overall structural research approach suggested. The study problems must be dealt with unambiguously at the start of the systematic analysis and as a specified procedure in Stage 1, which appears to be the classification of a topic or analytic problems (Khan et al., 2003). To meet the demands of the review, the keywords of the research had to be established. Many keyword patterns in the sample are important for the review area of science to be assured. According to data sources, phase 2 requires detailed and exact analyses of the respective publications and archives (Khan et al., 2003).

An appropriate field of research should also be known and chosen to access various related sources and information. Besides, Step 3 involves the use of keywords in descriptions, scopes, and keywords for research of a given area (Moshood et al., 2020). This analysis's keyword is encoded and included in the known and then picked from publishers and journals lists. Research should be valid, without language constraint, and open to modifications from research questions if required. Ke, Wang, Chan, and Cheung (2009) proposed using a minimum parameter analysis to maintain compatibility.

Step 4 also requires the quality evaluation of the analysis to guarantee accuracy in methodology. The paper received for analyses and refinements must also be limited to the preference of attributes for an accurate evaluation. The conditions of some records from the previous search query must be cleaned up. Naturally, the previous step 3 search would offer a wide variety of mainstream questions and articles. A detailed review of the article's contents is therefore required (T.D Moshood et al., 2020). The compilation of the evidence is used in Step 5. The systematic review will be pursued here, based on articles mostly related to areas of concern, to describe and integrate the strong polished publications. Consequently, a field and meaning or form are supplied to extract the material (Lu & Liu, 2014). The reports are usually analysed and summed up by the analysis's parameters, existence, and conclusions.

3.2. Literature consideration

To save, identify, and interpret this research proof and information collected from the reviewed articles, the ATLAS.ti 9 software package was used. One benefit of using the software ATLAS.ti 9 was that for keywords, patterns, relationship charts, and other analysis features, easy access to quotations is possible (Chang and Hsieh, 2020). Using the ATLAS.ti 9 software, the auto-code innovation has initially been used for the primary stage of analysis to identify and mark as quotations all areas of the knowledge institution where ATLAS.ti 9 software was implemented (Friese et al., 2018). These quotations were grouped for appraisal into a separate register, and the quotes were regularly analysed in connection with the method of study. All papers were read repeatedly and clarified, driven by the research subject, to identify recurrent trends and ideas (Paulus and Bennett, 2017). To achieve three kinds of reports, the collected materials were planned. 1) Overall report: the papers obtained are initially explained by their research backgrounds to describe the literature assessment's overall intent. 2) Detailed description: This study's primary focus is on sustainable supply chain management in the manufacturing sector. Seven primary word forms discussed above distribute the obtained posts. The relevant items shall control a comprehensive report on the products obtained, such as the testing goals, strategies and productivities, the significance of sustainable supply chain management (i.e. advancement in the supply chain, sustainable supply chain management implementation, individual perspectives, customer satisfaction, service quality, imitations tools & examination components). 3) Lastly, an interaction review is a further argument on sustainable supply chain management in the manufacturing sector research for integrated design through multiple papers that were carried out (Moshood et al., 2021). Furthermore, a discussion on other possibilities, such as difficulty adopting sustainable supply chain management in the manufacturing sector, their benefit was

explained below (Chang and Hsieh, 2020).

3.3. A systematic review using ATLAS.ti 9 software

This section conserves the organization of the technique section-each phase of the research process is addressed. To save, identify, and interpret this research evidence, the ATLAS.ti 9 software package is suitable. For the research review, it requires five components: Purpose: This research aims to provide insight into the modern production and ultimate potential of supply chain management; Concentration: This article discusses supply chain management research features (i.e., goals, strategies, sustainability, outputs); Viewpoint: This analysis provides a neutral view on the study of articles; Design: This article is ordered by conceptual order first, then connected; Coverage: The literature coverage is extensively reviewed (Chang and Hsieh, 2020).

For someone unfamiliar with the software, the use of ATLAS.ti 9 tech (quotation, families, and network) jargon would certainly mean nothing. In contrast, Weisheng Lu and Yuan (2011) used machine terms and explained them to enable readers to consider what was happening. The researchers identified the methodological approach, software, and version in this description and what features were used for the analysis (quotes, codes, and system hierarchy with memos). The sense of quotes has been clearly expressed, and the relationship between quotes and codes (Paulus and Bennett, 2017). The researcher briefly explained how the software was used, which may help inform people unfamiliar with software for qualitative data analysis. One benefit of using the software ATLAS.ti 9 was keywords, topics, relationship charts, and other analysis features, as easy access to quotations as possible. In ATLAS.ti 9 software, Fig. 1 provides word cloud knowledge that helps novices understand how an understanding of software is allowed. In ATLAS.ti 9 applications, Fig. 2 represents a network view that demonstrates how the data codes are related to the six major themes arising from the manufacturing sectors, green supply chain, sustainability, and low carbon supply chain and supply chain management survey. In this case, the authors suggested that the data was generated using the network function of ATLAS.ti 9.

Word cloud: Running the Word cloud and creating ATLAS.ti 9 software knowledge helps novices learn how to view applications. Word clouds have become very common when viewing textual content, where a keyword's font size might reflect its frequency in the text. There are many methods for the organization of words (Friese et al., 2018). Word Cloud is an easy and intuitive visualization tool that is often used to provide a first impression of text documents. Usually, the most common words in a text are displayed as a weighted list of words in a particular spatial structure (e.g., sequential, circle, random). The words' font sizes indicate their significance or frequency of occurrence for graphical purposes or visually encode additional information.

On the other hand, (e.g., colour, position, orientation) are also varied in Fig. 1. For more in-depth text analyses, word clouds can serve as a starting stage. However, accessible word cloud visualizations offer very pintsize assistance in comparing various text documents' terms and word frequencies. (Friese et al., 2018). To overcome this restriction, we used ATLAS.ti 9 software, an extended word cloud visualization that systematically merges and displays the words from several text documents. It provides an outline of the papers and allows clearly apparent variations and commonalities in word usage. The required information for the word cloud is shown in Fig. 1.

Basically, the ATLAS.ti 9 software is made up of a series of smaller word clouds that define numerous document combinations. In a cantered sequence, the word clouds are organized with those reflecting the outer circle's individual documents and the combined ones of the inner circles. The cloud concept contains the words inside the innermost circle that exist in all documents. The background colour saturation, which increases with the degree of aggregation, reinforces this composition principle. The word cloud (Fig. 1) is explained in detail in this article. We describe the visualization theory and its application after summarizing the related work.

Open coding: Upon initial analysis of text results, the researcher will recognize several words, sentences, and other words of interest related to this article or field of interest with the open coding feature of the ATLAS.ti 9 software package. A "quotation" is labelled with Open Coding and uses the same wording to produce a message from the same passage. It is not uncommon to come to a point where we will have more than a couple of pages of codes as we begin developing codes with fresh ideas (Friese et al., 2018). At that point, to find the correlations and classify them into classes based on their common properties, we may research the codes. We may also consider the codes' dimensions that reflect the property's position within a continuum or set. The name of the category can vary from the codes to help communicate its width, and if appropriate, we may even create sub-categories from the codes and then apply them to the categories (Soratto et al., 2020). Open coding is usually the initial stage of qualitative data analysis. We may do

Fig. 1. *Word cloud information on sustainable supply chain management.*

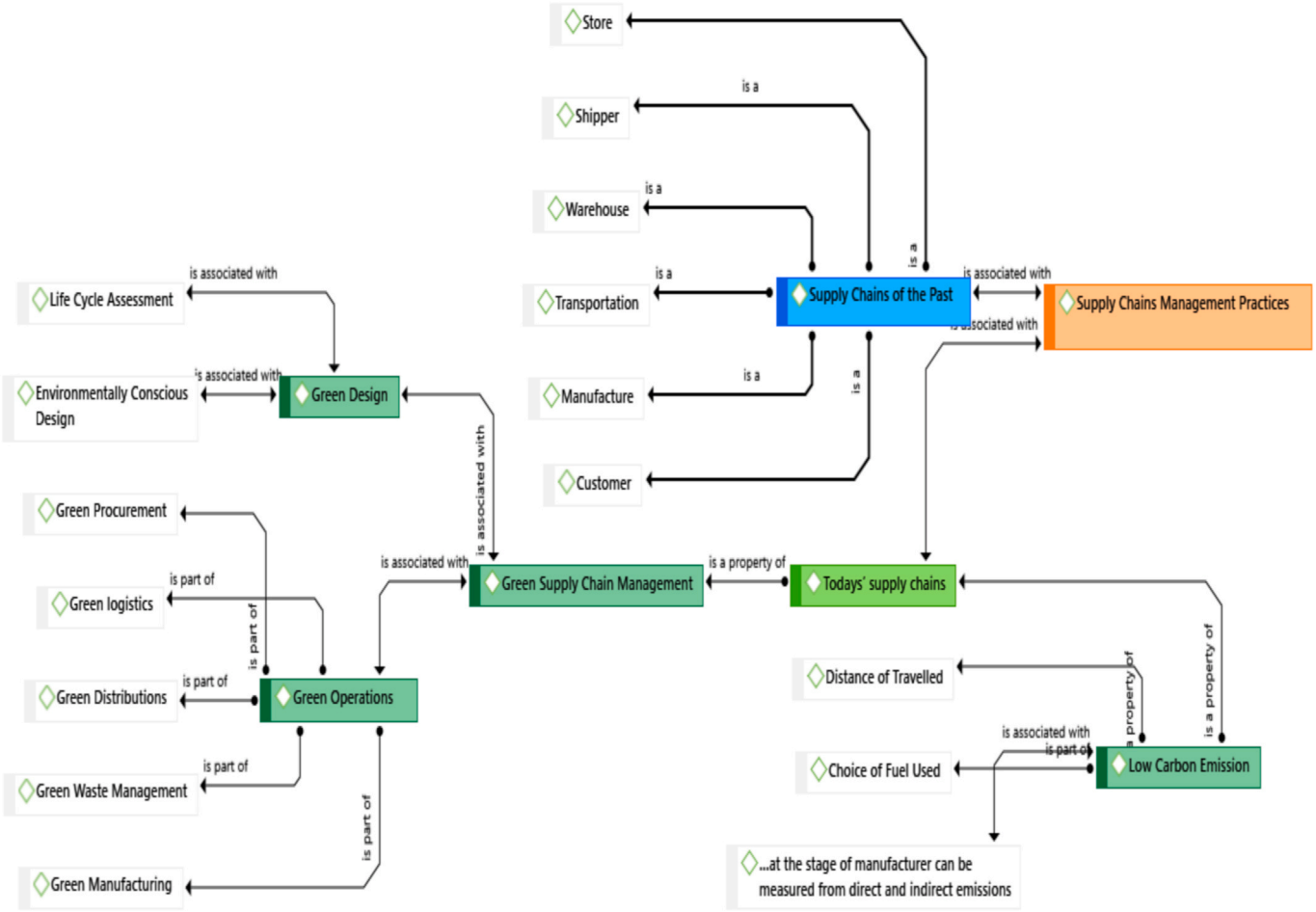

Fig. 2. *Atlas.ti network view on Past and Today's supply chain management Practices.*

gravitational coding and selective coding after finishing open coding, depending on the technique we use. At the later stage of the study, such coding enables one to create models in an inductive process. The required information for mathematics is shown in Fig. 2.

Data Analysis: The principal investigator had a clear overview of the data after designing the coding frame. It optimized the codes used to interpret and re-read the data several times. Concerning the research issue, the next step was to group codes into a coherent pattern. It's like creating a plotline where a portion of the plot is made up of the theme. Twenty-three code groups were formed to review the case study data and further summarized into seven subject areas that serve as the first ideas for themes (see Fig. 2). Fig. 2 illustrates how the codes surrounding work-related problems were further discussed in the theme creation process. The network feature ATLAS.ti 9 software was used for this. Codes that all contributed to the past supply chains, the supply chains of today, and the supply chain's sustainability management were drawn into a network and connected to each other. This is not an automatic method (Soratto et al., 2020). The software creates no connections or names the links. The software only provides the researcher with space for conceptual thought. This occurs as the networks arrange the nodes, think of meaningful connections, and name those connections. For example, the above network (Fig. 2) indicates that supply chain management activities were either irrelevant to the past supply chain, today's supply chain, green supply chain management, low carbon emissions, green design, and green operation.

4. Supply chain of the past

Fig. 2 shows how the organisation handles its supply chain in the past and today's practices. Past supply chain management's concept evolution can be divided into three phases: physical distribution management, where the main emphasis was on the distribution of the finished product; logistics management, where the main focus was on optimizing internal operations; supply chain management, where the focus was on integration across organizational boundaries (Al-Am and El-Naddaf, 2013). It is important to remember the past supply chains' essence to recognize the challenges and threats that today's supply chains pose. This is because, by adopting the standards and guidelines established in the past to existing supply chains, many challenges occur in today's supply chains. In the past, lengthy stretches of relative stability characterized supply chains (Christopher and Holweg, 2011). Compared to today's, low levels of customer control and supply chains were shorter and, therefore, more 'manageable.' With this as a context, supply chain performance initiatives revolved around producing demand for customers while increasing the profits across all supply chain ties.

As a result of such relative flexibility and restricted forces redirecting supply chain emphasis, supply chain executives started to focus more and more on rising productivity by decreasing operational costs, maintaining leverage to reduce uncertainty, lowering inventory, and eventually competing on quality (Christopher and Holweg, 2011). This method performed very well for several years, and businesses profited greatly from this strategy as part of the supply chains. Supply chains have rapidly expanded worldwide, benefiting from inexpensive sources of labour and raw materials, more lucrative investment options, emerging export markets, and, in many cases, the incentives provided by host governments to draw global markets. According to Christopher and Holweg (2011), very lean supply chains have been developed through techniques such as outsourcing, inventory reduction, just-in-time

principles, and growing firm cooperation. The most cost-effective operational models have been made feasible in a climate of greater prosperity, enhancing investors' economic benefits (Liu et al., 2018).

For this cause, Giannakis (2016) argued that while environmentally secure, supply chains aimed at raising sales, cutting costs (reducing stocks, just-in-time inventory), and optimizing assets, for example, were aimed at enhancing financial efficiency. Over the years, the business climate has started to shift as supply chains were getting more and more effective. Markets started to be marked by increasing client control (in such a way that today supply chains are strongly influenced) (Griffith et al., 2006); consumer value shocks, political volatility; currency fluctuations; and shifts in global markets, to name only a few.

5. Today's supply chain

Although the Supply Chain Management (SCM) concept was born at the beginning of the 1980s, research in the field was almost non-existent until the mid-1990s. Since then, the growth of SCM research has been exponential. Currently, SCM is making the change from being an emerging research field to becoming a consolidated one. Green supply chain management is the fourth phase of supply chain management incorporating sustainability thinking into supply chain management, from strategic product design to final product distribution to clients and end-of-life management (Al-Am and El-Naddaf, 2013). This progress is still continuing, and the nature and function of supply chain management in the future have yet to be determined (Rajeev et al., 2017). Considerable thought has been provided to supply chain management's green facets, whereas social problems are hardly reached. The concept and scope for managing the green supply chain in the literary sector vary from green transactions to integrated green supply chain operations (Foo et al., 2018). The green supply chain here is described as "integrating environmental thought into supply chain management, including product design, material sourcing, and purchases, manufacturing processes, distribution of the finished product to customers, and the end-of-life management of the product after its useful life (Jermsittiparsert et al., 2019)."

The principle of green supply chain management as a possible strategy for enhancing environmental sustainability is introduced by practitioners and academicians (Tseng et al., 2019). While the idea of green supply chain management can be found in the early 1990s, the growth pattern in academic publications indicates that after 2000 it gained traction (Rezaee et al., 2017). Seuring and Müller (2008) clarified that since the 1990s, the green supply chain management concept found its systematic form in a new discipline. For years, the idea of green supply chain management has grown (Tseng et al., 2019). The application of environmental management concepts to the whole collection of operations over the entire customer order period is stated by Handfield et al. (1997). As Fig. 3 indicates, the green supply chain development challenges have been divided into various groups depending on their background.

In order to reduce the environmental effect of the product, green product development plays an important role (Srivastava, 2007). It is generally accepted that earlier environmental factors have expanded the potential to mitigate the impacts on product design (Bag et al., 2020). In the design phase, 70 percent of the product cost has been estimated. Practising clinicians have developed instruments such as Simapro, Gabi, etc., to create the atmosphere (DfE) (Ali et al., 2020). Birch, Hon and Short (2012) compared and graded DfE methods into four outcomes pathways in terms of their outputs. The inference is that concentrating on product-specific performance will lead to better DfE. However, the supply network architecture does not double the influence of architecture when it relies on systems and does not seek to disregard the product design that affects network implementation (Sauer and Seuring, 2017).

5.1. Green manufacturing and re-manufacturing

This is a very important area within green operations. Three fields of research: pinch analysis (Linnhoff, 1993), industrial energy (Boustead

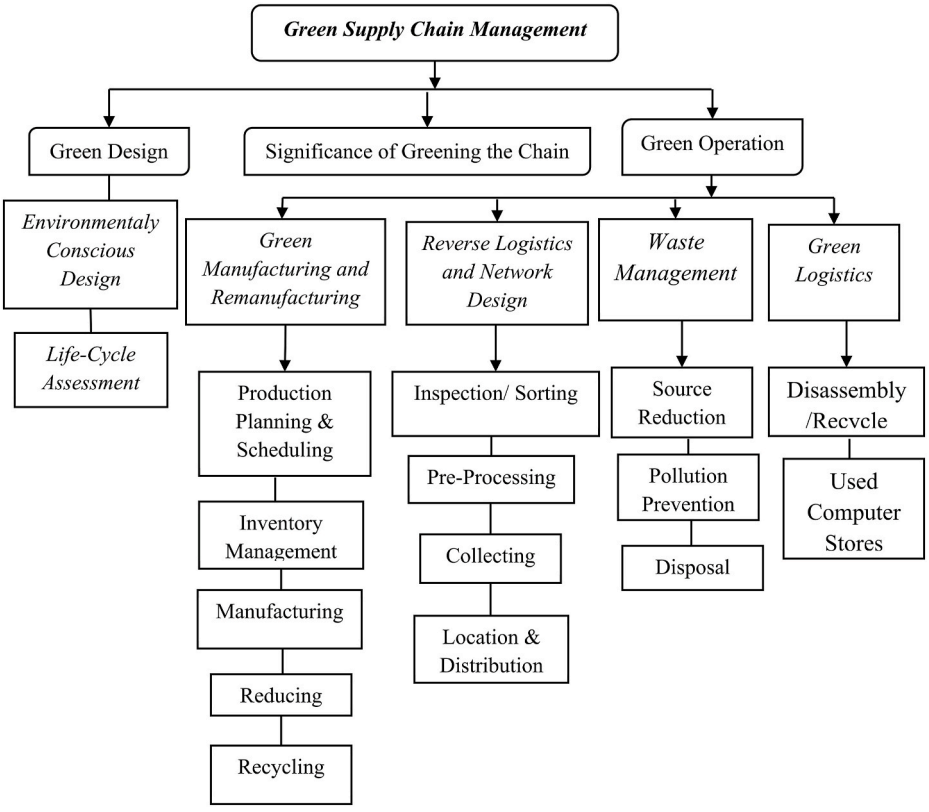

Fig. 3. Activities in the green supply chain of the Manufacturing Sector.

and Hancock, 1979), and energy life-cycle analysis (Rajesh, 2019), study the techniques to minimize energy and resource consumption in the inbound operations. According to Ninlawan et al. (2012), green industrialisation will contribute to lower raw materials prices, better output quality, decreased environmental and occupational health costs, and enhanced corporate identity. Findings from green manufacturing practices of the Manufacturing sector are described:

Control of dangerous substances:

1. Lead-free replacement for other chemicals like bismuth, zinc, silver, gold, copper
2. Rinse sections with clean water and re-use the product instead of using chemicals
3. Quality control at inputs from the vendor site and test again before accessing.

Energy-efficient technology:

1. Reduce power usage in goods such as HDD charging/unloading technology
2. Increase the service life of the company resulting in more excellent performance and profitability
3. Boost machines operating hours
4. Enhance the efficiency of machines.

The minimization of waste and 3Rs:

1. Promotes parts re-use/re-cycling
2. Increase environmental awareness via 3Rs
3. Decrease indirect substances, such as glue epoxy

5.2. Reverse logistics and network design

Reverse logistics apply to transportation for the return, re-production, and re-use of parts and materials (Trochu et al., 2020) manufacturer for the benefit. The processes of reverse logistics are distinct from conventional logistics. Further researchers explored the mechanisms (Jack et al., 2010) and creation & execution (Aitken and Harrison, 2013) as well as the value of IT (Dekker et al., 2004), etc. In this field, the majority of researchers employ a quantitative modelling approach (Cruz-Rivera and Ertel, 2009), such as a stochastic programming approach (Listeş and Dekker, 2005) as a form of mixed-integer linear programming (MILP). A non-linear paradigm of mixed-integer programming to solve problems with reverse logistics (Zarbakhshnia et al., 2020).

5.3. Waste management

Waste management seems to be another main concern for managing the green supply chain and impacts carbon footprint control and comparisons. However, waste disposal entails many others, such as the removal of emissions. Researchers also researched waste management problems such as method design (Méndez-Fajardo et al., 2020), location of treatment facilities (Adeleke and Olukanni, 2020), nature of the distribution network (Yadav and Samadder, 2017), re-cycling (Garlapati, 2016) and other problems. The researchers also have examined the concerns of waste management. The source-reduction/pollution prevention (SR/P2), instead of 'removing' it after it has been developed, focuses on 'preventing' pollution from the source (in substance and manufacturing processes) (Yang and Lin, 2020). This principle can also be used for lowering greenhouse emissions. The preventive approach's core themes are "re-use" and "recycle." The combustion equipment overhaul and a priority waste re-cycling choice are the means by which the recyclers can reduce their carbon emission. However, the literature on waste control has not influenced waste gas handling by improving the re-cycling process network. The dilemma of carbon dioxide, for example, although CO_2 is not tainted, it can be "prevented."

5.4. Cleaner production

United Nations Environmental Program (UNEP) described cleaner production as a "continuous implementation of an integrated environmental policy for quality and risk-enhancing processes, goods, and services for humans and the environment" (UNEP 2014). Zeng, Meng, Yin, Tam and Sun (2010) clarified that the issues related to cleaner production's business activity are evaluated, and prospects for economic and environmental efficiency are enhanced. They were applied in numerous sectors, including mines (Jia et al., 2014), ceramic (Huang et al., 2013), alimentary (Sladkova and Loginova, 2016), and so forth. Cleaner development is basically based on assessing resource and energy flows across the enterprise and creating strategies for reducing waste and pollution.

5.5. Green procurement

Ecological or green procurement relies on environmental performance requirements in purchasing decisions (Blome et al., 2014). 'Purchasing' is a crucial supply chain management feature, which is reinforced by changes in GSCM efficiency (Wong et al., 2016). Several studies have found significant impacts on the business's environmental and financial results from green procurement (e.g., Appolloni et al., 2014). However, some sustainable procurement sectors have no apparent presence, and businesses remain in the early stages of growth regarding green procurement and supply management (Tate et al., 2017). The effects of environmental acquisitions on business efficiency are still inconclusive. Therefore, it is essential to examine how industrial businesses procure equipment to enhance their environmental performance by eliminating pollution and lowering energy and water usage (AlNuaimi and Khan, 2019).

5.6. Green design

Green design and environmentally-friendly include incorporating environmental-conscious product design and product life-cycle research within an organization and collaborative efforts around the supply chains (Liu et al., 2018). Gábriel (2016) has described the green design as actions performed during product creation to reduce the environmental effect of a product over its entire life cycle from the procurement of materials to the manufacture, usage, and ultimately the disposal. Products that are revamped only fall into effect if they can at least offer the items they replace (Hong et al., 2019). In other words, goods must be engineered to be technically long-lasting, sustainable, and re-generable after use and eco-friendly (Bag et al., 2018). Besides, using suitable products for production should be included in implementing green design and environmentally friendly. During the manufacturing process of supply chain management, preference should be given to raw material with strong re-cycling characteristics and the lowest environmental impacts (Le, 2020).

5.7. Low carbon emission supply chain management

Although there is a lot of correlation between the green supply chain management and the management of the lower carbon supply chains, the impetus to control businesses' green supply chain comes mostly from environmental conservation demands in local communities. Simultaneously, climate change concerns are creating more strains for companies worldwide. Similar to the SSCM, which has been presented in this last segment, researchers have investigated several facets of carbon cuts in supply chains. In the supply chain, Sundarakani attempted to model carbon footprints (Sundarakani et al., 2020). He notes that it is essential to consider the heat flow in supply chains better and that carbon pollution regulation can be turned into a heat flow analysis. Also, it

divided the supply line into phases, including vendors, transportation, plant, and warehouse, and measured emissions based on the model in each stage. Just one case indicates that the retailer accounts for 25% of the greenhouse emissions, 22% of transportation, 40% of processing facilities, and 13% of the warehouse distribution region. This is why the supply network level is analysed to reduce Greenhouse gas emissions (Sundarakani et al., 2020).

The carbon and energy emissions of the distribution connections and storage operations in the food & beverage supply chains have been estimated by Cholette and Venkat (2009). In order to measure the carbon intensity in the light of logic and storage data and parameters, Choleset & Venkat used the web-based tool "Cargo Scope." The program parameters and inputs are the positions of the device (stores, warehouses, and nodes), transport (modes and frequency, amount, consumption rate, batch transport), energy (type, temperature control), and storage (time of residence, usage rate).

The de-carbonization is also analysed at various levels of the supply chain. Hua, Cheng and Wang (2011) investigated how businesses handle carbon footprints under asset management's carbon transfer system. In terms of its carbon offset effects, Holweg (2014) evaluated the global source risk. Jira and Toffel (2013) addressed the providers' interaction with the reasons relevant to providers' readiness to divulge carbon details to purchasers. Other problems, including the accumulated loading of resources during output (Wang et al., 2016), waste management (Koh et al., 2012), have been addressed. The factory level was concentrated by Smith and Ball (2012). They also developed a "MEW" flow model (material, energy, and waste) to direct the systemic study of manufacturing facilities and help define and pick changes. Choi (2013) spoke about the effect on the retailer decisions of the carbon footprint levy. Researchers have also used carbon footprint calculation techniques in the supply chain of different goods and sectors, including egg manufacturing (Pelletier et al., 2014), bananas (Svanes and Aronsson, 2013), and ethanol (Pattara et al., 2016), and other consumer products, for example, Researchers use carbon footprints in the supply chain. Various transport methods are also researched, such as road freight (Piecyk and McKinnon, 2010) and marine transport (Rigot-Muller et al., 2013).

In the approach and framework of managing the supply chain in a low-carbon manner, however, there is a significant gap, notably from a realistic point of view rather than from theoretical approaches in which several conclusions are made. According to the aforementioned literature, the activities of the sustainable energy supply chain can be divided into four general phases: 1) Product: product design, package design, user term efficiency, waste management, re-cycling/re-use of products; 2) Procurement: purchasing, supplier management, supplier transport, waste management; 3) Output: internal generic production process, waste management; 4) Logistics: consumer shipping, reverse logistics, packaging design for shipment.

6. Modern supply chain developments

As supply chain managers adapt to developments resulting from the introduction of Big Data, digitization of the supply chain and Omnichannel marketing, many interesting things have been happening, to mention only a few (Riverlogic, 2020).

➢ *Supply Chain Digitization*

It will remain a necessity to digitize the supply chain, encompassing all initiatives to transform business processes into a single whole and incorporate emerging modern technologies. As defined by PwC, the purpose of digitization is a smart, effective supply chain environment that demolishes silos, builds clarity and increases responsiveness (Riverlogic, 2020). It envisages a modern age that replaces manual operations and provides the enterprise with a single view. This includes efforts to build paperless processes right through approaches to model supply chain processes and establish what-if scenarios.

➢ *Supply Chain Solutions to switch to the Cloud will continue*

While several companies do rely on outdated technologies for the on-premise supply chain, the future is in the cloud. Supply chain cloud computing, which is available in many ways, including Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS), provides simplicity, scalability and global scope while reducing the necessity to manage massive, costly on-premise computing infrastructure (Riverlogic, 2020). Cloud-specific spending in 2020 would rise six times faster than other IT investments, according to Riverlogic (2020). Cloud-based supply chain systems can operate alongside and complement on-premise supply chain apps, providing an improved user interface, greater functionality, and quick access to new features and updates.

➢ *Omnichannel supply chains have been the standard*

Businesses will make huge strides in delivering a genuine Omnichannel shopping experience in response to consumer requests. Omnichannel supply chains put greater pressures on logistics and supply chains with the overlapping needs of supplying individual customer orders as well as replenishing stock at retail locations, enabling buyers to easily buy online or in brick-and-mortar shops (Riverlogic, 2020). A full rethink of supply chain logistics includes a transition from single-to multi-channel supply to omnichannel supply.

➢ *Development in the chains of circular supply*

A transition from the conventional linear supply chain to the circular supply chain was discharged, and broken out goods are reused and reworked by manufacturers by redevelopment or recycling parts into raw materials. There is a strong indicator, aside from legal criteria for the safe processing and reuse of waste goods, that consumers prefer businesses that recycle materials, and several leading companies find added benefit across circular supply chains (Riverlogic, 2020).

➢ *Agile Supply Chains*

Supply chains need to be agile and flexible to perform successfully and capable of responding in a timely manner to changes. This is a dramatic departure from conventional thinking about the supply chain that relies on durability, continuity and low cost. A transition from offshore manufacturing to local or near-shore supply is one of the prominent supply chain management patterns (Riverlogic, 2020). Short delivery times and reduced shipping costs are among the advantages of this. Organizations may adapt more easily to shifts in demand with less cash locked up in storage.

➢ *Internet of Things (IoT)*

The Internet of Things (IoT) seems to be of age. As prices decline, research reveals that the number of organizations using IoT products has risen from 13% in 2014 to 25% in 2019. Through 2022, the IDC predicts 13.6 per cent annual expansion (Riverlogic, 2020). IoT helps companies, all in real-time, to manage inventory, automate stock reordering, and keep track of deliveries. Sensors can anticipate wear and tear on machinery, enabling replacement parts to be ordered in a timely manner. IoT improves transparency in the supply chain.

➢ *Big Data Modeling and Logistic Supply Chain Coming Closer*

Thanks to the digitization of the supply chain, the rise of IoT, and the greater transparency of consumer data, Big Data is here. Today, businesses have access to vast volumes of knowledge and use this to create

market insight ranging from knowing previous performances to forecasting future patterns (Riverlogic, 2020). It is possible to assess client expectations and business dynamics using Big Data and redefine the supply chain.

➢ *Machine Learning and Artificial Intelligence*

More companies are moving to artificial intelligence (AI) and machine learning with better access to Big Data to simplify processes and automate procedures. Estimates that there was a 270 per cent growth in the number of companies using artificial intelligence in the four years to 2019. Predictive analytics and deep learning algorithms are used to optimize forecasting and decision support structures, recognize purchase habits and simplify tedious warehousing and inventory management processes. AI is used by many companies to replace workers who do routine supply activities and to perform difficult supply chain calculations (Riverlogic, 2020).

➢ *Automation and Robotics in Logistics*

As businesses adapt to the competing demands of omnichannel supply chains, especially in terms of the need for agility and flexibility, several switches to robotics to accelerate labour-intensive tasks. Robots are suitable for routine activities such as sorting, counting, and warehouse for fetching and transporting items. The International Robots Federation expects demand for robots and cobots (collaborative robots) to rise in 2021, while Honeywell Robotics invests heavily in the automation of warehouse robotics (Riverlogic, 2020).

7. Sustainable supply chain management

The concept of sustainable supply chain management (SSCM) has become a significant subject of debate in supply chain management over the last decade. Ayres and Kneese (1969), who addressed topics of output, consumption, and externalities, are credited with the earliest definition of today's green supply chain. The academic group applied the idea to numerous market areas in the 1990s, such as production forecasting, re-manufacturing, inventory management, processing, storage, and re-manufacturing of produced items, preparation, monitoring, and reverse logistical problems (Taticchi et al., 2013). However, there is already a fairly new and underdeveloped sustainability policy and its relevance to logistics and supply chain management (Gupta and Palsule-Desai, 2011).

The research community has identified sustainable supply chains from multiple viewpoints. For instance, Mathiyazhagan et al. (2018) regarded risk management, culture, policy, and accountability as promoting sustainability aspects and described sustainable supply chain management as the strategic, consistent alignment and achievement of the social, environmental, and economic goals of an organization in the systemic arrangement of key organizational business processes to strengthen the organization's business processes Jüttner et al. (2010) argued that the introduction into supply chain management of a 'green' aspect is concerned with the factors and interactions between the management of the supply chain and the natural environment. Besides, he described GSCM as integrating environmental thought into supply chain management, including product design, manufacturing, and procurement of products, manufacturing procedures, market distribution of the finished product, and end-of-life strategic planning of the product after its useful life. In the face of a wide range of meanings, it is difficult to determine the product's nature and limits (Jadallah and Bhatti, 2020).

However, in literature, Mathiyazhagan et al. (2018) have noted that sustainable Supply Chain Management or Green Supply Chain Management concepts and ranges vary from green procurement to decentralized supply chain movements from downstream to upstream, even to the reverse logistics. Abukhader and Jönson (2004) pointed out the relevant topics in reverse logistics, pollution analyses, logistics greening, and supply chain management. These meanings and claims draw attention to the basic principles and their role in creating sustainable supply chains for reverse logistics (Lee et al., 2012). The long-running reverse logistics of sales, reconstruction, and re-cycling remains an increasing field of logistics and supply chain management (Yu et al., 2020). Reverse logistics have been described as a method to recover or simply dispose of the inventory of goods at the end of their lifetime (Yang et al., 2020). Reverse logistic technology has achieved greater recognition for strategic advantages, brand reputation, and efficiency for customers across the supply chain culture, and in particular, from logisticians (Jadallah and Bhatti, 2020).

The design has also accumulated significant significance over the years as a technical instrument for handling the natural, social and economic impacts of goods. In nature, 80 percent of the supply chain cost is assumed to be established and controlled. In the existing literature, the design was addressed as the core method to adapt quickly to evolving consumer requirements (Ho et al., 2015), minimize production development cycles, increase product efficiency, understand and take advantage of supply chain reaction technologies, mitigate prices, threats, and lead times (Foo et al., 2018). While still enhancing product quality, manufacturers combine environmental and social concerns with conventional product design. Sustainable literature proposals provide suggestions for incorporating sustainable growth into the design, such as multi-stakeholder cross-functional teams, the exchange and coordination of knowledge with supply chain stakeholders, and the early participation of vendors in design (Fargnoli et al., 2018).

A wide variety of literature has also cantered on collaboration and knowledge exchange for sustainability-related guidelines, regulations, and programs for government departments, NGOs, working committees, and CSR bodies (Grant et al., 2017). For example, cooperative partnerships with NGOs strengthen a company's capacity to proactively, more rigorously and earlier adjust sustainability risk management than competitors. Therefore, Foerstl, Reuter, Hartmann, & Blome (2010) concluded that external resilience is an essential component of complex capacities for sustainable supply chain management that would be compensated with a competitive edge. Miemczyk and Luzzini (2019) analysed current SSCM literature. They concluded that there are numerous and varied stakeholders at the network level, such as clients, companies, states, NGOs, owners, lobbyists, rivals, vendors, and individual managers. With varying power and control frameworks, these different, inter-connected, and interconnected entities can differ in aims and priorities. However, they need to consider each other's positions and impacts on the more extensive network for sustainable buying and procurement since it is challenging to address restrictions without such knowledge. This illustrates the importance of consistent, constructive partnerships between businesses and different stakeholders.

Sustainability initiatives, which allow organizations to create capability, particularly in the supply sector, for example, financial assistance to suppliers' environmental programs, training and preparation programs, and the provision of written advice on the creation and execution of sustainability initiatives (Miemczyk and Luzzini, 2019) have also been highlighted in the literature. Capacity growth strategies embedded into GRI metrics such as workforce preparation, training and production, and R&D's need for new and creative product growth were stated. In addition to broad and deep stakeholder involvement and developing internal and external relationships, Smith and Sharicz (2011) elaborated on the leadership role in capacity growth through knowledge, collaboration, incentives, and results. A significant area of study in sustainability literature is creativity in new product and process growth (Çankaya and Sezen, 2019).

Researchers have documented many ground-breaking emerging product and process projects beyond conventional sustainable or eco-design projects. For instance, Green et al. (2012) have documented storytelling for sustainability's strategic advantage. With tradition, partnerships, and natural products, a special narrative establishes

emotional ties between consumers and retailers. Likewise, the Marks & Spencer Sustainability Strategy and creative marketer initiative were outlined by Kotzab et al. (2011) and Zhu and Sarkis (2004), looking beyond the labelling. Researchers stated that re-cycling, re-manufacturing, and restoration had been used more effectively to minimize waste and save energy. A paradigm of creative processes to incorporate sustainability in business operations is zero-residue, the replacement for inventory details, product modularity, disassembly design, or environmental design (Zhu et al., 2007). Researchers, however, still indicate that such measures would boost the difficulty, expense, and operating problems in the supply chain (Heckmann et al., 2015), making adoption problematic due to their low financial status and lack of funding, in particular for SMEs.

Ljungberg et al. (2007) argued that a product should be turned into service as the critical method for achieving sustainability in an environment in which items are replaced by services referred to as practical or utility economies. Within such a scheme, suppliers or producers concentrate on expanding the production cycle and optimizing the goods' utilization while taking care of the environment during the products' life cycle. Suppliers are taking over other activities, including supply, repair, warranty, update, servicing, recovery, and recycling. Examples include the loan instead of selling, copying equipment, coffee machinery, and automobiles (Kumar and Shekhar, 2019).

8. Motivators for implementation of SSCM strategy

Researchers have categorized sustainable supply chain management motivators into internal and external motivators (Sajjad et al., 2015). Two sub-categories are further divided into internal motivators: instrumental and normative motivators. Second, the instrumental view suggests that implementing a sustainability approach leads to strengthening stakeholder corporate image and credibility and reducing operating costs and performance, contributing to its environmental and economic sustainability (Oelze et al., 2020). Conversely, the normative perspective holds that a corporation adopts a sustainable policy because of corporate participants' religious or ethical values. This (normative rationality) orientation helps a corporation meet its legal and moral responsibilities to its customers and function in society as a responsible corporate citizen (Luthra and Mangla, 2018). Thus, motivated by regulatory prudence, a corporation and its members plan to "do the right thing" by practising sustainability. In particular, top management views itself as a constructive donor to public benefits, including social well-being and environmental stewardship (Gábriel, 2016). External factors, on the other hand, can also push firms to follow the SSCM approach. These variables include market drivers (e.g., competitiveness, consumers and user demands), government (e.g., rules and regulations), and societal considerations (e.g., institutions of civil society and media), which may force sustainability to be embraced by corporations (Zhu et al., 2005).

9. Research findings and discussion

The literature reviews above indicate that recent research has paid little attention to the sustainable, green, and low-carbon supply network, while research on the supply network/supply chain has been in its growth for two decades. The study also indicates that, due to the urgency of climate change, the issue of carbon is among the most critical areas to be recognized in the supply chain network. The review further shows a significant research gap in understanding organizations' behaviours from the viewpoint of external factors related to environmental strain at the system level. In specific, a new view of the network and its constituents, ties between organizations and other network players, is not yet in place. When the network is under pressure to adjust, this new insight arises (Foo et al., 2018). The practical analysis also demonstrates that, as the first step in managing an emission profile, measuring the network's carbon footprint is complicated, time-consuming, and expensive for most businesses. The need for a process model for effective carbon emissions assessment is high, but current theories and practices do not sufficiently satisfy it (Rahman et al., 2014). While there is a lot of literature on the configuration and design processes of the supply network, there is currently restricted literature that offers detailed guidance on sustainability, green and low-carbon supply chain network enhancement, especially in the manufacturing sector, as well as specific recommendations or a list of best practices that can be pointed to provide industry practitioners with step-by-step recommendations (Liu et al., 2018).

This study also indicates that a critical problem for the business sector is sustainable supply chain management. The existing market climate is increasingly pushing firms outside their organizational limits to embrace sustainability. There is an increasing awareness among professionals that the solution to social and environmental challenges is increasingly driven by corporate survival and competition (Liu et al., 2018). However, the study showed that not all organizations are at the same level of sophistication in sustainable supply chain management implementation. Business approaches to sustainable supply chain management often vary, with some companies struggling with environmental supply chain problems. In contrast, others consider social concerns critical to ensuring positive efficiency in supply chain management.

The outcomes have shown that corporations tend to be intensely interested in improving their environmental efficiency intra-organizationally. In this respect, businesses have implemented sustainability practices at the internal supply chain management level to amplify their environmental efficiency. However, in terms of resolving their inter-organizational environmental efficiency, it seems like corporations' dedication is missing (UKEssays, 2020). In order to enhance their green supply chain management efficiency, very few businesses consciously cooperate with their supply chain network partners (Sahoo and Vijayvargy, 2020). The results showed that green supply chain management activities are often based on contextual variables, including consumer desire and willingness to pay, market needs, product type, perceived level of stakeholder pressure, financial availability, legislation, and capability and expertise.

To attain better intra-organizational green supply chain management efficiency, organizations have employed various green supply chain management practices and programs, such as cost savings, savings in environmental impact, waste reduction, and operating productivity. However, at the inter-organizational level, along with the upstream and downstream SCM levels, many firms lack a similar environmental tendency (Gábriel, 2016). Relatively few firms have well-established internal processes and frameworks to interact with supply chain stakeholders to maximize green supply chain management performance between organizations.

The results presented in this paper are also identified as the positive effects or consequences of the sustainable supply chain's successful management. An organization's extent achieves its market-oriented priorities, and its financial goals are organizationally responsible (Li et al., 2006). Zhu, Sarkis and Geng (2005) concluded that facilitated by proximity and the inter-company connection could contribute to improved environmental performance. Conversely, collaborations between producers continue to embrace and develop emerging sustainable innovations. This will improve environmental performance, coupled with cooperation between consumer and manufacturer staff, collective agreements, and collective R&D (Afroz et al., 2019). The SCP's short-term objectives are specifically to improve efficiency and reduce stock and capacity utilization in terms of supply chain output. The long-term targets are to optimize market share and sales for all supply chain members. Financial indicators act as a way to assess entities and evaluate an organization's actions over time.

The supply chain's efficiency has become a significant sustainable source of benefit in many industries due to increasing global demand (Hoole, 2005). Organizations need to focus on the supply chain's total

results because it is a significant measure of the company's effectiveness. Prajogo and Olhager (2012) suggests that sustainable supply chain management has a dual role in increasing both individual corporate productivity and supply chain quality overall. The SCOR model is focused on five distinct process categories, including design, source, development, output, and return (Gu et al., 2016).

These possible benefits are based on the connection between sustainable supply chain practices' economic, social, and environmental performance. 1). Decreased health and welfare expenses and lowered training and staff attrition benefit from safer transport and warehousing and better working standards. 2). Lower prices, reduced lead times, and increased product consistency consistent with introducing the ISO 14000 specifications offer a basis for environmental management; 3). Sustainability initiatives would render the product more appealing to both manufacturers and customers. 4). Lower labour costs – improved working practices would boost productivity and performance and reduce supply chain staff's absence. 5). Proactive formulation of future regulations; firms proactively resolving environmental and social problems that affect government policy as this legislation relies on the organizations subsisting production and sustainable supply chain processes, resulting in a comparative edge that is impossible for corporations and their suppliers to replicate. 6). Reduction in price due to reduced recycling capacity and waste Product waste (Zailani et al., 2012).

Therefore, companies need to define their highly-rated capabilities and a comprehensive stock of information on their strengths. Deliberate measures determine the level of ecological supply chain stability in the context of credible supply systems management. Sustainable supply chain managers can use polycentric mechanisms to optimize the match between contexts of information, action, and the supply chain in ways that allow organizations to react more adaptively at appropriate levels. They are required to incorporate self-organization mechanisms that enable the supply chain to preserve and re-create its identification and adaptation mechanisms that enable the sustainable supply chain to progress over time in pursuing a fixed set of management goals and approaching new goals as the context changes.

9.1. Economic implication

Macroeconomic sustainability is concerned with handling finite resources successfully and efficiently to promote macro-economic growth and prosperity. According to Kopnina (2017), economic resilience is associated with financial indices' well-being like GDP. Fundamental economic strategies define it as the spectrum of social challenges aimed at securing values rooted in human and natural resources. GDP was determined by the Gonçalves et al. (2017) as the total economic output value. Further, regulated interest rates and inflation, fair, effective trade markets, low unemployment rates, healthy trade balance, and other favourable monetary and fiscal conditions are core macroeconomic stabilization components (Khan et al., 2020). Generally, national policymakers have concentrated mainly on improving economic development regardless of the detrimental effects on a country's social and ecological structures (Saint Akadiri, Alola, Akadiri and Alola, 2019).

An organization must retain diverse financial wealth types to attain economic viability–tangible and intangible assets. Equipment, land, structures, inventory, financing, etc., are tangible properties. On the other hand, intangible assets include a reputation for a brand, creativity, ethos, and employees' tacit skills and talent (Wheelen and Hunger, 2010). Furthermore, the management of immaterial assets is interlinked with social and environmental aspects of sustainability, which demonstrates the interlinked existence of the dimensions of sustainability. According to the study by Carroll et al. (2013), the basis for economic resilience is for a corporation to accept other aspects of responsibility, including its legislative, ethical, philanthropic, and environmental responsibilities or its social well-being.

9.2. Environmental implication

The emphasis is on the control of harmful environmental effects of company activities in terms of ecological sustainability. According to Kopnina (2017), recent research on environmental sustainability, unrestrained economic development is one of the most significant risks to the natural world and ecological processes. Kasayanond, Umam and Jermsittiparsert (2019) describe environmental sustainability as the protection and renewal of the present and the potential generations' biosphere. Recent environmental dangers such as climatic change, global warming, pollution, erosion, and biodiversity depletion are global issues. Consumers are rapidly pressuring businesses to implement environmentally sustainable policies to boost their efficiency (Khan et al., 2019).

Companies may contribute significantly to addressing increasing environmental issues by incorporating environmentally sustainable activities in their business activities. However, some administrators also find the gains to be outweighed by the costs of sustainable operation (Danso et al., 2019). Some practitioners view environmental policy as an anti-business activity, hampering the productivity of a corporation and raising short-term production costs, according to Morelli (2011). At present, however, many proactive businesses are engaged in enhancing their environmental efficiency. These businesses perceive environmental protection as an essential condition for satisfying different stakeholder groups' requirements and a basic necessity for gaining a sustainable competitive edge on the marketplace. Porter and Van der Linde (1995) proposed a parallel enhancement of environmental sustainability and profitability through environmental program investments. They also argued: Environmental standards well planned could cause inventions that lower or increase the value of a commodity's overall cost. These advances enable industries to use various inputs from raw materials to electricity and labour, thereby offsetting the expense of improvement and breaking the stalemate. In the end, increased efficiency of capital renders firms more competitive than less competitive.

9.3. Social implication

The social dimensions of sustainability are reflected in corporate social responsibility (CSR) and are sometimes used interchangeably as "social sustainability" and as "CSR." Trendafilova et al. (2013) described CSR as "the company's continuous contribution to ethical actions and contribute to economic growth while increasing its quality of life well as the local and social communities at large. Equity issues are the core goals of minimizing poverty and increasing the health of developed nations.' So the idea of social sustainability addresses the cultural, economic, social, and emotional needs of a human being (Kopnina, 2016).

Basically, many researchers concluded that social sustainability includes effective social capital management. The social capital can be seen as a long-lasting commodity of an organization that is not used depreciated but instead refined and has to be held on a long term basis (Baland et al., 2018). Social capital creation within an organization also involves management to establish a desirable working atmosphere, where workers improve social skills and other skills. This can be achieved by changing aspects like investing in human resources, enhancing workforce ability, fostering a collaborative working community, networking opportunities, access to the information available, and gaining new knowledge more productively and efficiently. Social capital also helps an organization at a larger scale to increase the standard of education, eliminate development and tackle hunger and other public severe problems at the systemic level (Saint Akadiri, Bekun and Sarkodie, 2019). According to academics, accessing the developing foreign markets is most comfortable for businesses engaged in fostering social responsibility, attracted and hired qualified staff, consumers of interest, and investors, retaining strong community ties, smoother credit access for financial institutions, and an enhanced image. This leads to a strategic edge in business.

10. Conclusion

The aim of this research was to clarify why and how companies implement sustainable supply chain management techniques. And the literature review indicates that several researchers have explored the association between applying diverse collections of green supply chain management strategies and different aspects of organizational performance. In terms of economic implications and from the viewpoint of recycling, a considerable amount of study has been devoted to analysing the ecological supply chain (Simão et al., 2016). However, there is a lack of an overall understanding of applying best practices in the green supply chain in terms of organizational performance. It is absent from both theoretical and practical research. Besides, no research considered the effect on organizational efficiency environmentally, economically, operationally, and socially in introducing the seven major SSCM practices (green manufacturing, green design, low carbon emission, green procurement, cleaner production, waste management, and reverse logistics/network design). Moreover, none of the previous studies has examined these practices' development to organizations' performance in the manufacturing sector.

However, social and environmental concerns are not tackled universally by enterprises, and context-dependent variables decide the sustainable implementation of supply chain management. Such firms rely more on social problems than those for which other community elements are of vital importance. Results suggest that organizations are more focused on improving intra-organizational supply chain management efficiency, while more effort is needed for inter-organizational supply chain management. The current research has improved the awareness of sustainable supply chain management in the manufacturing sector. Specifically, the study has strengthened the current understanding concerning motivators for implementing sustainable supply chain management.

Furthermore, the report shows that the value of partnering with supply chain collaborators to optimize environmental sustainability has received a great deal of interest from contemporary researchers. Studies maintain that it is important to cooperate with vendors, consumers and logistics service providers to exchange environmental knowledge, mitigate forms of emissions, and jointly achieve environmental objectives. In addition, the research shows that in recent years there has been a growing number of articles on different models of mathematical optimization to boost decision-making in search of GSCM. Since new sub-disciplines and divisions are thus emerging, businesses face new obstacles. The most likely focus of the implementation of mathematical models is on addressing emerging problems. In addition, consistent work on the measurement of GSCP and GSCM output has been found across the timeframe. Also, on the basis of content interpretation, the paper provides a detailed but straightforward conceptual structure.

This study also indicates that sustainable supply chains should follow poly-centred structures to allow businesses to react more adaptable to expertise, experience, and supply chain contexts at appropriate levels. We need to implement self-organization mechanisms that enable the supply chain to sustain and rebuild its recognition and adaptation mechanisms. The supply chain can promote the achievement of a common management goal over time and resolve new goals as the environment shifts.

Due to globalization and the related growing delivery of value-added operations, and the expansion and increasing sophistication of supply chains, the importance of sustainable supply chain management is also increasingly recognized by organizations. The study also shows that the supply chain's efficient management must be evaluated and focused on both strategic and operational dimensions. Future research on the topic of sustainable supply chain management should focus on broad-based case studies conducted in developing and other economic sectors for major transnational equations, and it must be understood. The established process model must mitigate other sectors and branches (Green et al., 2012).

Besides, collaboration among essential stakeholders in the manufacturing industries must be strongly concerned in order to achieve productivity and success at SSCM. Below are some relevant suggestions: 1). Propagate SSCM awareness and promote the use of environmentally sustainable products and services to set up a directly accountable unit to take over electronics waste only, effectively, which reverse logistics. 2). Expand the product's lifetime by developing models for dismantling or upgrading rather than buying new ones or leasing services. 3). Eco-design development: the approaches combined with technological creativity that lead to the steadily improved environmental value of the finished product to integrate environmental issues into product design and development. A transition in product design triggers the creation of eco-sustainable goods focused on two principles: (1) intended to prolong the product's lifetime. It can be changed, replaced so reused, such as modular design. (2) Recycle/disassembly products that could be more recoverable at the end of their existence. 4). Hazardous materials control RoHS compliance and other regulatory requirements. 5). Established parameters for manufacturing waste disposal and recognize more recycling facilities investment. 6). Promoting sustainable public system services (PSS) and combinations of public functions have alluded to potential sustainable growth theories. The new term PSS has the potential to reduce both the development and consumption of environmental impacts. Consequently, the prospect of fulfilling consumers' requirements is substituted for traditional material-intensive product uses when more dematerialized facilities are provided. 7). Encouraging renovation & recycling by awakening awareness of reuse/recycling of manufacturing through campaigns/activities. 8). Enhance extended product responsibility initiatives; EPR is an environmental safety system that focuses on the polluter pays principle to make a manufacturer of opioid responsible for the entire drug production cycle as well as its packaging. 9). Establish a database unit to collect and record information on production, import/export, and waste management. 10). Incorporate reverse logistics creation teams and skilled train laboratories.

It is also up to senior management and supply managers to instil governance frameworks to help sustainable supply chains adapt and convert susceptibility communications. Companies need to define their existing capabilities and assets first-what they can do more successfully than their competitors. Second, by defining their sensitivities to the external and internal supply chain. Supply practitioners need to organize the supply chain partnerships to manage sustainable supply chain management and build the flexibility required to succeed today and improve the flow of knowledge and coordination activities.

11. Limitation and suggestions for future research

The results give diminutive profound insight into sectoral gaps in the sustainable application of supply chain management. Therefore, a more thorough understanding of industry-relevant problems that affect the implementation of sustainable supply chain management is desirably to analyse the sustainable management of supply chains in specific regions. Recent results can also be generalized analytically in Malaysia's market climate but do not reflect the general population. Further studies are required in other geographical regions and countries to investigate sustainable supply chain management.

This research has strengthened the awareness of the sustainable application of supply chain management, considering these restrictions. A variety of avenues in future studies can be studied, depending on the framework given by this report. This research also discussed aspects of sustainable supply chain management from the manufacturing point of view. Sustainable supply chain management issues are also relevant for vendors as they play an essential role in global manufacturing and sustainability. This gives future studies opportunities to study industrialists' sustainable application of supply chain management problems in developed and emerging nations. Therefore, future studies will be focused on the development of approaches for a process model that

can be used and applied in any industry and industrial sector.

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Declaration of competing interest

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