Enhancing the economics performance of manufacturing firms through supply chain sustainability and green management in Pakistan

Syeda Sabeen Jafri
Lecturer, Khadija Girls College Karachi

Zeeshan Ahmed Sheikh
Team Leader, Dairy Land Private Limited, Karachi

Received on: 06-07-2023 Accepted on: 11-08-2023

Abstract

The study's objective was to investigate how green warehousing, social values and ethics, logistics optimization, and supply chain risk impact the sustainability of SC, ultimately influencing the economic performance of manufacturing companies in Pakistan. Methodology: A quantitative approach was employed to gather data from SC professionals located in Karachi, Pakistan. The sample size is estimated at 150 responses that will be analyzed using multiple regression analysis technique. The anticipated outcomes of this study are likely to demonstrate that green warehousing, social values and ethics, logistics optimization, and SC risk exert a noteworthy influence the sustainability of the SC. Moreover, the managers will be recommended to further improve their warehousing based on reducing the use of paper that will eventually help in mitigating warehouse waste. Also, managers will be recommended to adopt eco-friendly packaging and adopt material that is green for the enhancement of their sustainability in the SC.

Keywords: Green Warehousing, Social Values and Ethics, Logistics Optimization, Supply Chain Risk, Supply Chain Sustainability.

1. Introduction

1.1 Background of the study

The degradation of the environment, worldwide warming, along with change in the climate have all been caused by the release of greenhouse gases, insufficient disposal of waste, the manufacturing of goods that aren't recyclable, and the incorrect application of substances in supply chains (SC). These factors also pose a grave threat to human existence (Le, 2020). Companies integrate environmentally friendly and socially responsible practices into their SC to reduce their ecological impact, ensure social security, and make them more efficient, gain competitiveness, meet demand from stakeholders and gain access to new products. Socially and environmentally conscious approaches are implemented by reducing greenhouse gas emissions, waste generation, and the consumption of resources and power to ensure the security or well-being of workers also additional parties involved (Raza et al., 2021).

Additionally, due to growing environmental concerns, potential economic benefits, or regulation strain, supply chain management (SCM) now places a higher priority on the effects of sector on the surroundings and the safeguarding of earth's ecosystems. Consequently, a lot of executives are increasingly utilizing feasible SSCM to power the vendor connections (Govindan et al., 2020).

Similarly, green warehousing (GWH), a crucial step in the SSCM process, entails keeping, finding, acquiring, or transferring components, raw, under construction, or final products. Businesses that run sustainable warehouses strike a balance among the practical effect of the warehouse on the immediate environmental and social problems as well as financial ones like cost of ordering as well as pricing (Indrawati et al., 2018). The equilibrium among economic, social, and environmental factors has to be preserved since one factor can affect another. Three strategies that can be utilized to lessen the environmental impact of warehouse operations include carbon credits, tree planting, and equipment for carrying goods improvements (Torabizadeh et al., 2020).

1.2 Problem statement

Global environmental crises and the loss of human life have been attributed to industrial activities. This has led various stakeholder groups, for example expertise in legislation or conservation work, for stricter governmental regulations in response to the escalating environmental issues worldwide (Khan et al., 2018b; Kumar & Dixit, 2018). In response to this, governments have implemented more stringent regulations that mandate sectors and businesses to follow certain sustainability guidelines (Bai et al., 2019). It is crucial for the sustainable development agenda to address these concerns and pressures from multiple stakeholders. Consequently, companies have started integrating sustainability principles into their operations and SC (Bai & Sarkis, 2018). Companies are increasingly acknowledging the advantages and essential nature of sustainability for the purpose of gaining an edge over others in response to the diverse demands along with influences of various stakeholders (Bai et al., 2017). As the focus on sustainability reshapes the fierce rivalry, both companies or SC are compelled to reevaluate their procedures, technology, merchandise, as well as industry tactics. Sustainable manufacturing and development, often referred to as industrial ecology, offer a route toward sustainability. To address sustainability challenges in their manufacturing processes and SC, organizations can employ sustainable innovation approaches. However, firms face considerable challenges in implementing long-term SC innovation when they strive to innovate for lasting sustainability. These organizations encounter numerous hurdles in their pursuit of long-term sustainability through innovation (Gupta et al., 2020). To foster the acceptance, application, and expansion of Sustainable Supply Chain (SCS) ideas, it is imperative to recognize and surmount these impediments. Nevertheless, due to resource constraints, addressing all these challenges simultaneously proves to be an arduous task for these entities. Numerous studies have established comprehensive frameworks for enduring SCM and emphasized an importance of SSCM continues with creativity. However, there has been a noticeable gap in research as there have been no specific efforts to delineate the criteria for implementing sustainable innovation in the context of SSCM, and this area remains unexplored within an industrial context (Kusi-Sarpong et al., 2019).

1.3 Significance of the study

The findings of this study will provide industrial executives and experts with useful information and suggestions, specifically those working in the manufacturing sector in Pakistan. This information will assist them in making sustainable warehouse-related decisions and enhancing the performance of their SCS.

This study offers practitioners a clear and convincing basis to promote social values and ethics (Social V&E) policy or SC procedures. Furthermore, the study will equip practitioners with effective ways to establish optimized logistic operations, implementing GWH while also recognizing Social V&E to promote SCS. The study will also highlight the necessity of collaboration between suppliers/customers, which helps practitioners implement green storage, optimize logistics, and acknowledge Social V&E successfully.

In order to effectively manage the relationship with SC members, the study will contribute critical approaches to operators' resource sharing through the executive of green storage, logistical optimizations, and social and ethical values to turn firms into competitive advantages to improve their economic performance. Additionally, the suggested framework will aid professionals in categorizing their warehouses based on different levels of sustainable investments. This study provides practitioners with Techniques to ensure that logistics optimization (LO) and GWH are successfully maintained, making it advantageous for policymakers to take a look and indicate levels of performance and to achieve a considerable decrease in emissions of waste and gas.

1.4 Outline of the study

There are five sections to this study. The study's context, problem statement, research objectives, and questions are all included in the first section, along with the study's scope and limitations. In the second section, we delve into the literature review, the formulation of hypotheses, and the proposed research model. The third section covers the research methodology, involving the research design, sampling approach, data gathering methods, instrumentation, statistical techniques, and ethical considerations. Moving on to the fourth section, present a thorough analysis of the research findings and engage in an in-depth discussion. Lastly, in the fifth section, will have synthesize findings from the research, offer managerial recommendations, and outline potential future directions.

2. Literature Review

2.1 Theoretical Background

According to the resource-based view of the firm (RBV), an organization's competitive edge over over the long term is due to the value, rarity, uniqueness, and non-substitutability of its resources and skills (Barney, 1991). The Natural Resource-Based View (NRBV) takes into account the finite limits of the Earth's natural resources, as noted by Hart in 1995. Consequently, supply chain management (SCM) operations need to be redesigned in order to simultaneously attain both economic and environmental sustainability.

In order to accomplish both corporate and environmental sustainability, Hart developed a set of three interrelated techniques in 1995: avoiding environmental damage, responsible

handling of goods, as well as sustainability. Continuous enhancement methods are used in a climate change avoidance strategy to lower output (Hart, 1995). A business could carry out this strategy internally by investing in manufacturing methods that reduce trash or contamination (Hart, 1995). In line with the pollution prevention strategy, environmentally conscious suppliers are required to supply designated eco-friendly raw materials, while end consumers are responsible for providing or recycling the end products. Consequently, both upstream and downstream partners in the SC must demonstrate full commitment for a dedicated firm to effectively execute a pollution management strategy. Product stewardship incorporates environmental stakeholder concerns into a company's products.

Over the past 15 years, the bulk of Natural Resource-Based View (NRBV) activities have generally concentrated on pollutant administration, with experimental studies on product governance or equitable growth strategies receiving little to no consideration. In fact, one of the most frequently debated topics in organizational and environmental research is the question of whether and under what circumstances adopting environmentally friendly practices is beneficial (Berchicci & King, 2007; Hart & Ahuja, 1996). Although Sustainable Supply Chain Management (SSCM) is intended to encourage the use of NRBV resources, SSCM also promotes the NRBV. The NRBV is a well-known idea in SSCM, even if it might not be very useful (Golicic & Smith, 2013), this causes a chasm among concepts and their implementation (Hart & Dowell, 2011).

2.2 Hypothesis Development

2.2.1 Green warehousing and supply chain sustainability

Warehousing plays a vital role in both internal and external logistics and distribution processes. Abushaikha (2018) suggests that warehouses can introduce non-value-added tasks because of the numerous processes linked with their operations. These activities within warehousing result in a substantial generation of waste in the SC, requiring the adoption of waste-reduction measures and regulations to counter their adverse effects on the environment and human well-being. This underscores the importance of giving specific focus to warehousing within logistics for SCS project implementers. It helps in meeting stakeholder expectations and achieving a benefit over competitors (Abushaikha, 2018). Numerous academics (Çankaya & Sezen, 2019b) there has been recognition of the necessity to encourage the use of renewable energy sources and procedures together with cost-efficient operating systems due to the relevance of warehouse sustainability, to address warehouse- associated challenges. Additionally, green packaging is seen as a cost-saving approach by reducing material requirements and optimizing use of the warehouse (Agyabeng-Mensah, Ahenkorah, Afum, Dacosta, et al., 2020). Therefore, the hypothesis has formed:

H1: green warehousing has a significant effect on supply chain sustainability

2.2.2 Social values, ethics, and supply chain sustainability

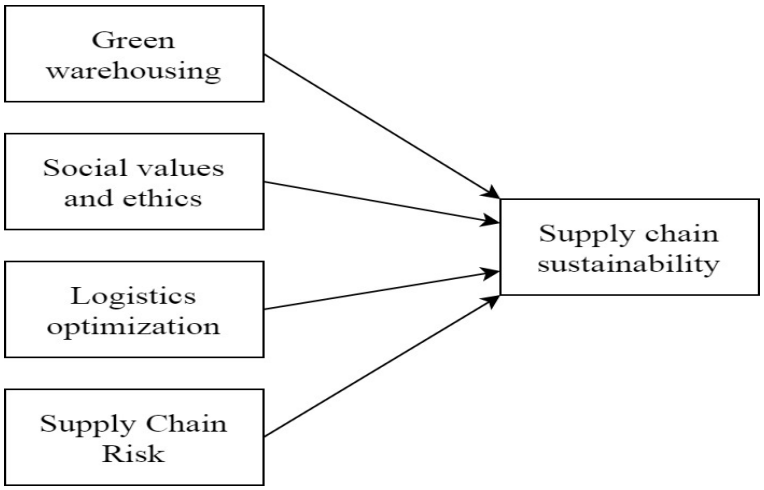
According to Dubey et al. (2017), in recent times, researchers have placed significant emphasis regarding the function of social values and ethics in sustainable development, leading to substantial debates. Social V&E pertains to the practice of participating in ethical and socially responsible actions to improve SCS (Agyabeng-Mensah, Ahenkorah, Afum, Dacosta, et al., 2020). To establish business viability initiatives successfully, it is imperative

for management to inspire employees by involving them in the organization's activities, enabling them to understand the company's key concerns, and embracing its newly formulated concepts. According to scholars, ethical procurement and purchasing practices are associated with improved environmental performance (Croom et al., 2018). Ethical procurement involves acquiring goods and materials from suppliers with ethical practices that do not harm people or the environment. It prioritizes responsible sourcing practices to protect both human well-being and the environment by choosing and procuring fresh items and supplies from vendors that have actions align with these values (Agyabeng-Mensah, Ahenkorah, Afum, Dacosta, et al., 2020). An ecologically conscious SCS is developed and advanced in large part because to engineering ethics. Therefore, the hypothesis has formed:
H2: social values and ethics has a significant effect on supply chain sustainability

2.2.3 Logistics optimization and supply chain sustainability
Logistics operations play a crucial role in the SC, and their inherent characteristics often make them environmentally unfriendly. Transportation and logistics activities significantly contribute to pollution and the emission of greenhouse gases (Khan et al., 2018a). The quantity of power needed for highway freight transportation is rising quickly as consumer appetite for goods and services increases. This escalation leads to the generation of greenhouse gases that have adverse effects on human health and contribute to environmental degradation (Hishan et al., 2019). This suggests that the effects of operational actions can be detrimental to both ecosystems as well as human wellness. In order to mitigate these negative environmental consequences and ensure sustainability, it is imperative to optimize logistical activities (Agyabeng-Mensah et al., 2019). LO stands for the execution of tactics aimed at mitigating externalities while enhancing profitability in the realm of green (SC) endeavors. The adoption of green logistics techniques yields positive effects on both environmental and social performance. To achieve ecological and social sustainability objectives, companies might find it necessary to collaborate with SC partners, sharing resources and expertise, according to Agyabeng-Mensah, Ahenkorah, Afum and Owusu (2020). Thus, the hypothesis has formed:
H3: logistics optimization has a significant effect on supply chain sustainability

2.2.4 Supply chain risk and supply chain sustainability
The escalation of risk within the SC is a longstanding issue, or organizations continually grapple by uncertainties concerning both financial aspects and the punctual delivery of their products. The increasing interdependence among SC participants has expanded in recent times, and while this interdependence offers various advantages, it also carries the potential for generating risks (Shahin et al., 2019). SC risk can be affected by ecological along with organizational components which depend on the SC itself. These variables are not consistently predictable and can significantly influence the output variables of the supply chain. An observable characteristic of these risk factors is their dependence on the structure of the SC (Gouda & Saranga, 2018). Supply chain risk (SCR) poses a significant challenge to sustainable supply chain management (SSCM). SCR leads to significant problems such as volatile environments, uncertain supply and demand dynamics, and unexpected disruptions, all of which have become increasingly common in recent times (Shafiq et al., 2017). Numerous

supply chains struggle when it comes to addressing these challenges. SCRM research. Shahin et al. (2019), stated that sustainability concerns have largely been overlooked, with numerous studies having previously focused separately on SCR and SCS based on existing literature. Hence, the hypothesis has formed:



H4: supply chain risk has a significant effect on supply chain sustainability

3. Research Methodology

3.1 Research Approach

Two distinct research approaches are recognized as qualitative and quantitative. The quantitative approach has been identified helpful as the person that has quantitative knowledge can better conduct decision-making and compare between qualitative and quantitative sources (Anderson et al., 2018).

3.2 Research Design

There are two major research design named as experimental and non-experimental. The correlational design has been identified as a non-experimental in which it simply examines the relationships between two variables (Saunders et al., 2009). Hence, the correlational design has been used and it helped the researcher to examine the simple correlation between variables.

3.3 Sampling Design

3.3.1 Target Population

The present study has focused on professionals in the SC sector within the manufacturing industry of Pakistan.

3.3.2 Sample Size

The formula 50+8k has been employed to calculate the sample size for this study, where 'k' stands for the number of variables included (Krejcie & Morgan, 1970). With 5 variables in the research, a minimum of 90 responses were required. Consequently, the researcher set a goal of gathering at least 150 sample responses from the target population.

3.3.3 Sampling Technique

Two primary categories of sampling are known as probability sampling and non-probability sampling. The non-probability further includes purposive sampling that purposefully selects people within the target population (Cochran, 2007). This technique allows the researcher to select people using their judgments as it helps to gather relevant data from the respondents (Sekaran & Bougie, 2016). This research opted for purposive sampling because it facilitated the acquisition of pertinent data aligned with the research subject matter.

3.4 Procedure of Data Collection

The research employed a survey methodology due to its effectiveness in gathering a substantial sample size and its compatibility with a quantitative approach. This method use questionnaire instrument and asks respondents regarding their experiences related to the research topic (Kothari, 2004). The survey can be conducted in an online and in-person manner as it allows the researcher to be flexible in data collection (Pinsonneault & Kraemer, 1993). Hence, this research has applied both manner of data collection by using survey method.

3.5 Instrument of Data Collection

There are various instruments for data collection but questionnaire has been identified as a better fit for quantitative research. The questionnaire is based on close-ended questions regarding the research variables and it further includes a Likert scale (Kothari, 2004). The Likert scale allows the respondents to answer their questions in a more deliberate manner. The five-point Likert scale was employed in this study, which ultimately increases the relevance of the findings and the analysis's generalization (Baker, 2003). There are 5 variables in this research. The GWH includes 8 items adopted from Agyabeng-Mensah, Ahenkorah, Afum, Dacosta, et al. (2020) based on five-point Likert scale. For example, *"Our firm uses biodegradable packages in the warehouse"*. The social values and ethics include 9 items adopted from Agyabeng-Mensah, Ahenkorah, Afum, Dacosta, et al. (2020) based on five-point Likert scale. For instance, *"Our firm has developed internal ethical purchasing policies"*. The logistics optimization includes 6 items adopted from Agyabeng-Mensah, Ahenkorah, Afum, Dacosta, et al. (2020) based on five-point Likert scale. For example, *"Our firm reclaims products from customers for remanufacturing"*. The supply chain risk includes 9 items adopted from Wang et al. (2020) based on seven-point Likert scale. Like, *"Our firm focuses on inadequate operational strength (e.g., poor fleet/ delivery capacity)"*. The supply chain sustainability includes 6 items adopted from Agyabeng-Mensah, Ahenkorah, Afum, Dacosta, et al. (2020) based on five-point Likert scale. For instance, "Our firm focuses improvement in the firm's environmental situation".

3.6 Statistical Technique

There are multiple analytical methods available, with regression analysis being recognized as a foundational approach. This method proves to be efficient in assessing the connection between two variables and is well-suited for handling extensive sample sizes. Regression analysis is particularly valuable when it comes to hypothesis testing and deriving the primary findings in a research study (Ranganathan et al., 2017). Furthermore, in this research, a

reliability analysis has been carried out utilizing Cronbach's alpha. This evaluation is centered on assessing the reliability of both the study as well as its measuring instrument, with an acceptance threshold set at 0.70 for Cronbach's alpha (Bonett & Wright, 2015).

4. Data Analysis

4.1 Pilot study

The results of the pilot study, specifically the outcomes of pretesting the instrument through Cronbach's alpha, are displayed in Table 1.

Table 1: Pilot Study (n = 50)

Variables	N Items
Green Warehousing	8
Logistics Optimization	6
SC Risk	9
SC Sustainability	6
Social Values and Ethics	9

Vaske et al. (2017) has recommended that alpha reliability in pilot study (pretesting phase) should be higher than 0.60. The above table has shown that green warehousing with eight items, having alpha reliability of 0.671, logistics optimization with six items, having alpha reliability of 0.764, SC risk with nine items, with alpha reliability of 0.863, SC sustainability with six items, having alpha reliability of 0.874, and lastly, social value and ethics with nine items, having alpha reliability of 0.796.

4.2 Demographic profile

Table 2 below provides the demographic characteristics of 213 survey participants.

Table 2: Demographic Profile (n = 213)

		Frequency
Firm Size (No. of Employees)	Less than 250	43
	250 to 500	64
	500 to 1000	22
	1000 to 1500	31
	More than 1500	53
Industry Type	Pharmaceutical	33
	Food and beverage	33
	Textile	84
	Automotive	32
	Others	31
Designation	Procurement manager	86

	Supply chain manager	52
	Warehouse managers	33
	Logistics managers	42
	Below 1	33
Work Experience (Years)	1 to 5	64
	1 to 5	96
	10 and Above	20

4.3 Measurement model

Table 3 illustrates the outcomes of the measurement model, which was analyzed using the Partial Least Squares (PLS) algorithm.

Table 3: Measurement Model

Variables	Items	Loadings	Alpha	CR
Green Warehousing	GW4	0.682	0.700	0.815
	GW5	0.546		
	GW7	0.786		
	GW8	0.860		
Logistics Optimization	LO4	0.799	0.862	0.913
	LO5	0.926		
	LO6	0.918		
SC Risk	SCR4	0.743	0.871	0.904
	SCR5	0.927		
	SCR6	0.806		
	SCR8	0.757		
SCR9	0.802			
SC Sustainability	SCS2	0.833	0.913	0.935
	SCS3	0.781		
	SCS4	0.897		
	SCS5	0.920		
SCS6	0.874			
Social Values and Ethics	SVE1	0.640	0.872	0.900
	SVE3	0.672		
	SVE4	0.880		
	SVE5	0.727		
	SVE6	0.743		

		SVE7	0.810	
SVE9	0.758			

Hair et al. (2016) recommended on page no. 104 (exhibit 4.4) that outer loading should preferably be higher than 0.70 to achieve construct validity; whereas, outer loading between 0.40 and 0.70 should also be acceptable in case that the construct have achieved recommended thresholds for convergent validity *(see Appendix-B)*. Moreover, Hair et al. (2011) recommended that to establish an acceptable level of agreement between indicators and constructs, it is recommended that the alpha coefficient surpass 0.70, the CR exceed 0.80, and the AVE be higher than 0.50. As demonstrated in the aforementioned Table 3, all indicators and constructs have met the respective criteria for both construct and convergent validity.

4.4 Discriminant validity

Fornell Larcker Criterion (FLC)

Table 4 presents the outcomes of the Fornell and Larcker (1981) criterion analysis for assessing discriminant validity, which was conducted using the PLS algorithm.

Table 4: FLC Method

	GW	LO	SCR	SCS
Green Warehousing	**0.728**			
Logistics Optimization	-0.466	**0.883**		
SC Risk	-0.684	0.729	**0.810**	
SC Sustainability	-0.484	0.616	0.791	**0.862**
Social Values and Ethics	-0.592	0.582	0.779	0.855

It is suggested that for latent constructs, the square root of Average Variance Extracted (AVE) should be greater than the associated correlation coefficients in order to provide adequate discriminant validity. This presumption is based on the notion that constructs should be statistically distinctive if they are distinct in theory (Hair et al., 2016). The table displayed above indicates that the values in bold along the diagonal (representing the square root of AVE) are greater than the non-bold correlation coefficients with other constructs. As a result, the discriminant validity has been successfully established using the FLC method.

4.5 Cross Loadings

Table 4 below offers the outcomes of cross-loadings analysis conducted to assess discriminant validity, utilizing the PLS algorithm.

Table 5: Cross loadings

	GW	LO	SCR	SCS
GW4	**0.682**	-0.554	-0.546	-0.322
GW5	**0.546**	0.030	-0.289	-0.201

GW7	**0.786**	-0.527	-0.489	-0.424
GW8	**0.860**	-0.186	-0.618	-0.407
LO4	-0.643	**0.799**	0.552	0.352
LO5	-0.451	**0.926**	0.729	0.580
LO6	-0.259	**0.918**	0.636	0.634
SCR4	-0.615	0.504	**0.743**	0.559
SCR5	-0.689	0.562	**0.927**	0.713
SCR6	-0.572	0.614	**0.806**	0.449
SCR8	-0.450	0.697	**0.757**	0.487
SCR9	-0.459	0.606	**0.802**	0.837
SCS2	-0.448	0.533	0.652	**0.833**
SCS3	-0.553	0.690	0.636	**0.781**
SCS4	-0.446	0.580	0.793	**0.897**
SCS5	-0.422	0.421	0.693	**0.920**
SCS6	-0.253	0.467	0.636	**0.874**
SVE1	-0.608	0.491	0.614	0.431
SVE3	-0.448	0.458	0.574	0.454
SVE4	-0.515	0.380	0.578	0.693
SVE5	-0.297	0.425	0.537	0.835
SVE6	-0.235	0.427	0.444	0.457
SVE7	-0.571	0.572	0.707	0.592
SVE9	-0.491	0.381	0.645	0.788

When opposed to their cross loadings in other constructs, indicators of reliability need to have larger loadings in their own structures (Hair et al., 2011). Henceforth, indicators have been loaded higher in their constructs achieving discriminant validity using cross loadings.

4.6 HTMT ratio

Table 4 displayed below provides the outcomes of the HTMT (Heterotrait-Monotrait) ratio analysis used to assess discriminant validity, employing the PLS algorithm.

Table 6: Heterotrait-Monotrait Ratio (HTMT)

	GW	LO	SCR	SCS
Green Warehousing				
Logistics Optimization	0.641			
SC Risk	0.864	0.843		
SC Sustainability	0.594	0.675	0.839	
Social Values and Ethics	0.785	0.705	0.880	0.896

HTMT ratio below than 0.90 should be considered acceptable for discriminant validity (Hair et al., 2019; Henseler et al., 2015). In this regard, above table showed that highest HTMT ratio was found between social values and ethics (SVE) and SC sustainability (SCS) and therefore, discriminant validity using HTMT ratio has been achieved.

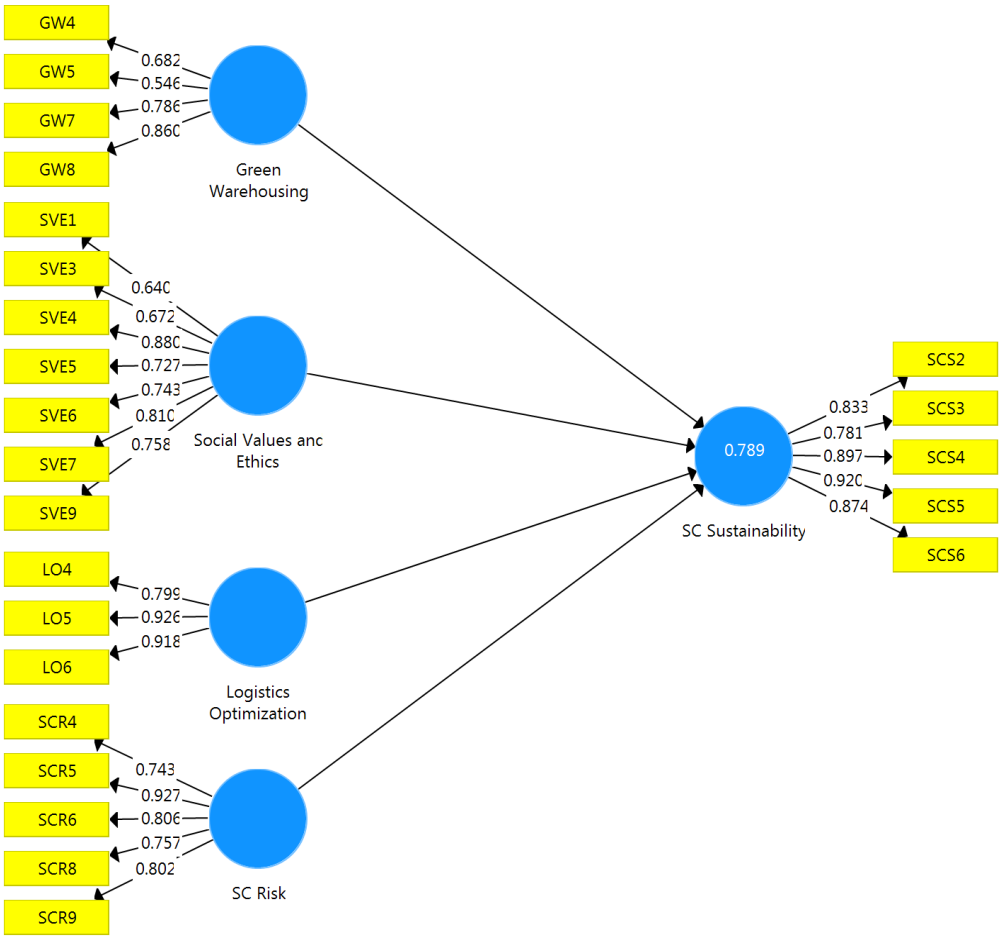


Figure 2: PLS Algorithm Illustration

4.7 Predictive relevance

Table 7 below displays the outcomes of predictive relevance assessment conducted using the PLS algorithm, along with the PLS blindfolding technique.

Table 7: Predictive Relevance

	R Square	R Square Adjusted
SC Sustainability	0.789	0.785

Above table has shown that SC sustainability has been explained upto 78.9 percent that is

considered as strong/high predictability in the structural model (Hair et al., 2011); whereas, it has strong relevance (57.8 percent) in the structural model (Hair et al., 2013).

4.8 Structural model

Path analysis

Table 8 presents the findings of path analysis carried out through PLS bootstrapping with 5000 subsamples and a significance level of 5 percent using a two-tailed approach.

Table 8: Path Analysis

	Estimate	**S. D.**	**T-Stats**
Green Warehousing -> SC Sustainability	0.175	0.029	6.037
Logistics Optimization -> SC Sustainability	0.052	0.031	1.698
SC Risk -> SC Sustainability	0.381	0.039	9.769
Social Values and Ethics -> SC Sustainability	0.632	0.023	27.350

In the table above, the data indicates that green warehousing ($\beta = 0.175$; $p < 0.05$) has a statistically significant and positive impact towards SC sustainability. Likewise, supply chain risk ($\beta = 0.381$; $p < 0.05$) also exhibits a statistically significant and positive impact on SC sustainability. Furthermore, social values and ethics ($\beta = 0.632$; $p < 0.05$) are found to have a statistically significant and positive effect on SC sustainability. However, it's worth noting that logistics optimization ($\beta = 0.052$; $p > 0.05$) demonstrates a positive impact, but it is not statistically significant in relation to SC sustainability.

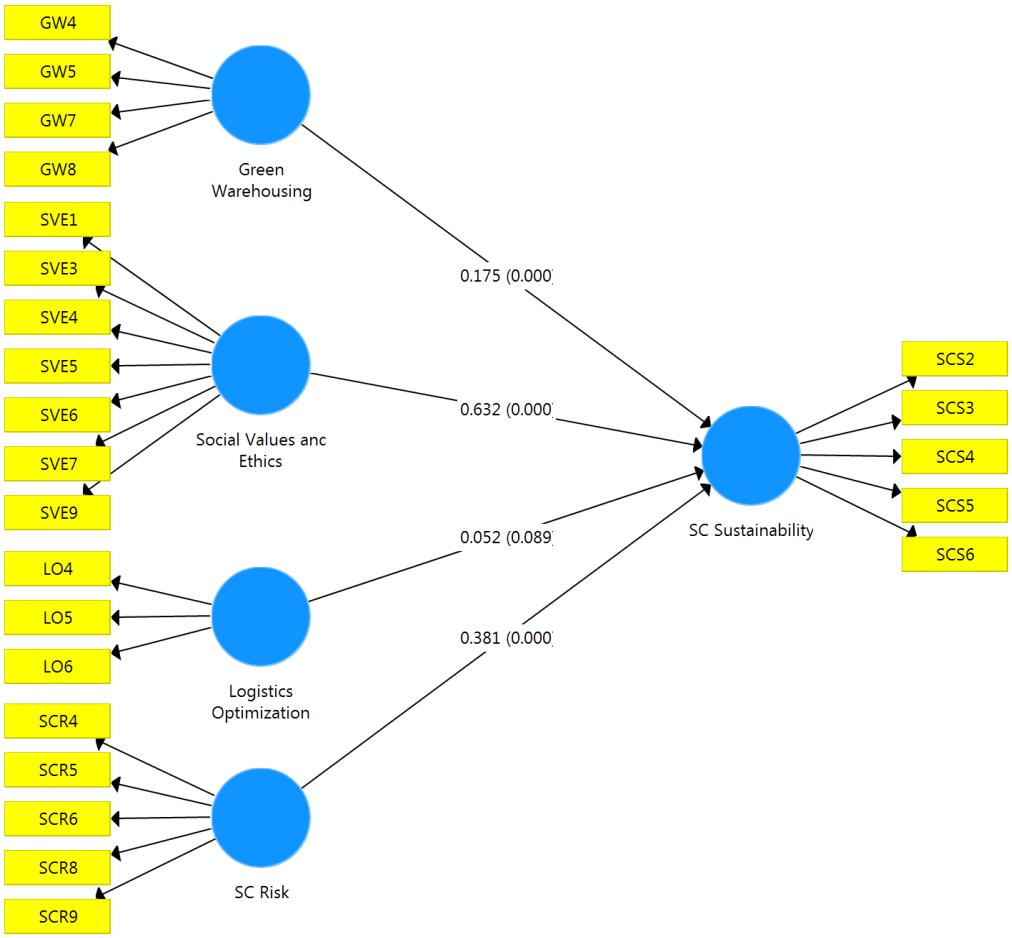


Figure 3: PLS Bootstrapping Illustration

5. Conclusion and Recommendations

5.1 Conclusion

The main goal of this study was to determine how social values and ethics, logistical optimization, and SC risk affect SC sustainability and, in turn, the financial performance of Pakistani manufacturing companies. The study methodically adopted purposive sampling as it facilitated the collection of pertinent data aligning with the research theme. The study specifically focused on SC professionals within manufacturing companies located in Karachi, Pakistan. A minimum of 150 survey responses were gathered from this specific demographic. Furthermore, the analysis of the data was carried out through regression analysis.

As far as results are concerned, study found a significant positive relationship between green warehousing and SC sustainability. Also, logistic optimization has an insignificant positive effect on SC sustainability. Moreover, SC risk has a significant positive relationship on SC sustainability. Similarly, social values and ethics has a significant positive relationship with SC

sustainability. Sustainability measures play a substantial influence in lowering supply chain risk, according to the study. Moreover, the results indicate that companies that engage in sustainability initiatives alongside their reactive risk management measures are able to further reduce their supply chain risk. As per the research findings, sustainability initiatives, obtaining backing from stakeholders, improving efficiency in operations, and increasing market share—advantages that were initially anticipated—also unanticipatedly produced extra benefits, such as the decrease of SC risk.

Also, the operational activities of businesses in the logistics sector significantly contribute to the release of greenhouse gases and harmful airborne pollutants, both of which pose health risks to individuals. According to this research, adopting eco-friendly warehouse practices and optimizing logistics processes can effectively reduce pollution, minimize waste, and lower the releases of gases that are hazardous. This, in turn, motivates to an improvement in the well-being of sociocultural participants. Moreover, embracing sustainable practices such as utilizing clean energy sources and reducing both waste generation and energy consumption not only helps companies meet the expectations of end consumers and other stakeholders but also conserves valuable resources for future generations and advances the overall ecological health of the planet. Additionally, the study highlights that emphasizing social values and ethical considerations has a positive effects on the sustainability of SC, indicating that this research provides insights into methods that prioritize the well-being and safety of employees and communities.

Objective One: Green Warehousing and SC Sustainability

The findings suggested that green warehousing has a significant positive effect on SC sustainability. Prior research has yielded identical findings. Agyabeng-Mensah, Ahenkorah, Afum, Dacosta, et al. (2020) found that the because of warehousing operations, more carbon dioxide is released into the atmosphere. Such as movement of vehicles also increases. In order to secure a competitive edge and fulfill the demands of stakeholders, it is imperative to give significant consideration to improving warehouse operations. This is necessary for the execution of SC sustainability efforts to be effective. Additionally, Ali et al. (2020) proposed that the most significant contribution to sustainability can be achieved by carefully selecting the location for green warehousing within logistics activities. Many companies are now focusing on green warehousing as a means conserving money and energy. Consequently, the adoption of green warehousing is leading to expense reduction, thus contributing to the assurance of SC sustainability. Likewise, Trivellas et al. (2020) supported the same results and stated that to improve efficiency of the overall SC, green warehousing is important. It has a direct impact on SC sustainability because it is fundamental to a logistics system. Therefore, green warehousing is of utmost importance in order to enhance and improve SC sustainability.

Objective Two: Logistics Optimization and SC Sustainability

The study further found that logistics optimization has insignificant positive effect on SC sustainability. This result is consistent with Agyabeng-Mensah, Ahenkorah, Afum, Dacosta, et al. (2020) who indicated that in order to mitigate negative environmental effects and ensure the sustainability of the supply chain, it is essential to optimize logistics operations. In simpler

terms, in order to increase profits and minimize external factors that could harm supply chain sustainability, companies should implement practices that enhance the optimization of their logistics operations. Also, Delmonico and Bezerra (2020) found that, to advance SC sustainability the companies should optimize their activities such as building their warehouses in place that ensure ecofriendly transportation mode use. Moreover, SC sustainability can be enhanced when logistics optimization is properly implemented through supplier and customer collaborative efforts.

Objective Three: SC Risk and SC Sustainability

The study found a significant positive relationship between SC risk and SC sustainability. This result is also consistent with Wang et al. (2020) who found that SC sustainability can be compromised or negatively impacted when logistics and transportation operations face risks. These risks may arise due to the unpredictability and unreliability of resources, leading to the potential development of disruptions in the SC, thereby affecting its overall sustainability. Pinheiro et al. (2019) also second the results. The research demonstrated that delays, damages, and losses in logistics operations can have negative effects, characterized as impacts, outcomes, and mistakes. These disruptions in normal logistics activities are a result of SC risks, which in turn pose a threat to SC sustainability.

Objective Four: Social Values and Ethics, and SC Sustainability

The study found a significant positive effect of social values and ethics on SC sustainability. Agyabeng-Mensah, Ahenkorah, Afum, Dacosta, et al. (2020) found that for ensuring sustainable development a huge role is played by social values or ethics. To improve SC sustainability, participating in morally and socially responsible activities is vital, as this encompasses the principles of social values and ethics. Similarly Dubey et al. (2017) found that, for the purpose to succeed SC sustainability, It is imperative, for the company's employees to actively engage in the business processes that align with the newly adopted vision of the company and have a clear understanding of the company's core issues. The effective adoption of social values or ethics guarantee the well-being as well as safeguarding of the employees. Likewise, Zhu et al. (2017b) indicated that through implementing social codes of conduct in design and growth of an ecofriendly SC the green competitiveness along with performance and sustainability would be improved. The implementation of ethical and social values in the SC contributes to an improvement in SC sustainability, creating a mutually beneficial opportunity for all stakeholders.

5.3 Managerial Recommendations

This study has offered several practical recommendations. Initially, the benefits of implementing a GMS can boost the economic achievement of manufacturing companies. Practitioners should make sure to highlight the benefits of such a system to organizational decision-makers. Consequently, this study can enlighten managers regarding the competitive advantages associated with a GMS. Furthermore, managers should work towards creating a positive perception of green management among investors, as firms are more inclined to adopt such a system if they believe it will garner favorable consensus. Additionally, the research has contributed to shaping subjective norms around GMS. Societal expectations,

including legal regulations and social conformity, play a significant role in motivating firms to embrace GMS. Therefore, managers should actively endorse the adoption of GMS, since they have the ability to improve monetary as well as non-monetary efficiency, enhancing the company's overall edge and corporate value in a variety of methods.

Secondly, the results of this study provide a sound basis for the execution of supply chain sustainability activities, including procedures like ecological storage, logistical efficiency, and the advancement of ethical and moral behavior. Similar to that, this study offers a convincing case for supply chain executives to support the incorporation of social and ethical rules and norms. Management also encourage the adoption of eco-friendly storage, community development, and logistical efficiency to advance sustainable supply chains. Furthermore, managers should foster collaboration between companies and their suppliers and customers, enabling cooperation in resources to assist in the execution of ecologically sound warehousing, the optimization of logistics, and the promotion of social morals and values. The cooperative strategy aims to increase revenue, competitiveness, earnings, and overall return investment performance while decreasing waste and the production of greenhouse gases as well as enhancing the wellbeing of both employees and communities.

Similarly, businesses have the ability to successfully develop their alliances with supply chain (SC) partners, transforming them into priceless sources of competitive edge and eventually enhancing their financial results. Employees are more likely to gain knowledge and environmentally aware skills as businesses work alongside SC partners, which may include consumers and vendors, on initiatives like adopting environmentally sustainable warehouse management practices, streamlining administration, and promoting social values and ethics. This puts the business in a better position to gain an edge over competitors and boost its bottom line. Consequently, it is of utmost importance for companies to recognize the vital role of involving both vendors and consumers in embracing green warehousing, optimizing logistics, and upholding social values and ethics. Furthermore, to improve financial success, managers ought to integrate sustainable approaches that encompass both social and environmental factors.

Furthermore, modern employment innovation is being propelled by information and communication technology, enabling individuals to participate actively. It may also play a role in fostering collaborative efforts within the realm of corporate social responsibility. With managers increasingly recognizing the importance of corporate social responsibility, a major goal is to encourage collaboration between insiders (such as workers, managers, or proprietors) and outside interests (such as vendors, customers, the general public, and the governing body). Consequently, stakeholders may explore more efficient global solutions to decrease overall expense or improve profitability.

Finally, the study of SC risks has gained considerable attention in both research and practical applications. By using objective metrics like as co-word analysis, co-citation networks, and decoupling relationships, managers can obtain insight into the intellectual landscape of this sector and identify key areas where decision models and support systems are established. Consequently, executives should explore both current and new trends in the industry, and also incorporate methods for supply chain risk management (SCRM), to increase their comprehensive understanding of supply chain risks. Furthermore, the substantial growth in sustain-

able SCM underscores the necessity for innovative business models that place a special emphasis on social and environmental dimensions.

References

1. Chatzoudes, D. and Chatzoglou, P. (2022), "Antecedents and effects of green supply chain management (GSCM) practices"
2. Leung, T.C.H., Guan, J. and Lau, Y.-Y. (2023), "Exploring environmental sustainability and green management practices: evidence from logistics service providers"
3. El-Garaihy, W.H., Farag, T., Al Shehri, K., Centobelli, P. and Cerchione, R. (2022), "Driving sustainability in supply chain management for a more inclusive and responsible future"
4. Appiah, M.K., Odei, S.A., Kumi-Amoah, G. and Yeboah, S.A. (2022), "Modeling the impact of green supply chain practices on environmental performance: the mediating role of ecocentricity"
5. Abushaikha, I. (2018). The influence of logistics clustering on distribution capabilities:qualitative study. *International Journal of Retail & Distribution Management*.
6. Acquah, I. S. K., Agyabeng-Mensah, Y., & Afum, E. (2020). Examining the link among green human resource management practices, green supply chain management practices and performance. *Benchmarking: An International Journal*.
7. Agyabeng-Mensah, Y., Afum, E., Acquah, I. S. K., Dacosta, E., Baah, C., & Ahenkorah, E. (2020). The role of green logistics management practices, supply chain traceability and logistics ecocentricity in sustainability performance. *The International Journal of Logistics Management*, *32*(2), 538-566.
8. Agyabeng-Mensah, Y., Afum, E., Agnikpe, C., Cai, J., Ahenkorah, E., & Dacosta, E. (2020). Exploring the mediating influences of total quality management and just in time between green supply chain practices and performance. *Journal of Manufacturing Technology Management*.
9. Agyabeng-Mensah, Y., Ahenkorah, E., Afum, E., Dacosta, E., & Tian, Z. (2020). Green warehousing, logistics optimization, social values and ethics and economic performance: the role of supply chain sustainability. *The International Journal of Logistics Management*.
10. Agyabeng-Mensah, Y., Ahenkorah, E., Afum, E., & Owusu, D. (2020). The influence of lean management and environmental practices on relative competitive quality advantage and performance. *Journal of Manufacturing Technology Management*.
11. Agyabeng-Mensah, Y., Ahenkorah, E. N. K., & Osei, E. (2019). Impact of Logistics Information Technology on Organisational Performance: Mediating Role of Supply Chain Integration and Customer Satisfaction. *Journal of Supply Chain Management Systems*, *8*(4).
12. Anderson, D. R., Sweeney, D. J., Williams, T. A., Camm, J. D., & Cochran, J. J. (2018). *An introduction to management science: quantitative approach*. Cengage learning.
13. Bag, S., Gupta, S., Kumar, S., & Sivarajah, U. (2020). Role of technological dimensions of green supply chain management practices on firm performance. *Journal of Enterprise Information Management*.
14. Bai, C., Kusi-Sarpong, S., Badri Ahmadi, H., & Sarkis, J. (2019). Social sustainable supplier evaluation and selection: a group decision-support approach. *International Journal of Production Research*, *57*(22), 7046-7067.
15. Bai, C., & Sarkis, J. (2018). Integrating sustainability into supplier selection: a grey-based TOPSIS analysis. *Technological and Economic Development of Economy*, *24*(6), 2202-2224.
16. Bai, Q., Chen, M., & Xu, L. (2017). Revenue and promotional cost-sharing contract versus two-part tariff contract in coordinating sustainable supply chain systems with deteriorating items. *International Journal of Production Economics*, *187*(1), 85-101.
17. Baker, M. J. (2003). Data collection–questionnaire design. *The marketing review*, *3*(3), 343-370.
18. Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of management*, *17*(1), 99-120.
19. Bonett, D. G., & Wright, T. A. (2015). Cronbach's alpha reliability: Interval estimation, hypothesis

testing, and sample size planning. *Journal of organizational behavior*, *36*(1), 3-15.
20. Çankaya, S. Y., & Sezen, B. (2019a). Effects of green supply chain management practices on sustainability performance. *Journal of Manufacturing Technology Management*, *30*(1), 98-121.
21. Çankaya, S. Y., & Sezen, B. (2019b). Effects of green supply chain management practices on sustainability performance. *Journal of Manufacturing Technology Management*.
22. Cochran, W. G. (2007). *Sampling techniques* (3rd
23. ed.). John Wiley & Sons.
24. Croom, S., Vidal, N., Spetic, W., Marshall, D., & McCarthy, L. (2018). Impact of social sustainability orientation and supply chain practices on operational performance. *International Journal of Operations & Production Management*.
25. Dubey, R., Gunasekaran, A., Childe, S. J., Papadopoulos, T., Hazen, B., Giannakis, M., & Roubaud, D. (2017). Examining the effect of external pressures and organizational culture on shaping performance measurement systems (PMS) for sustainability benchmarking: Some empirical findings. *International Journal of Production Economics*, *193*, 63-76.
26. Golicic, S. L., & Smith, C. D. (2013). A meta-analysis of environmentally sustainable supply chain management practices and firm performance. *Journal of supply chain management*, *49*(2), 78-95.
27. Gouda, S. K., & Saranga, H. (2018). Sustainable supply chains for supply chain sustainability: impact of sustainability efforts on supply chain risk. *International Journal of Production Research*, *56*(17), 5820-5835.
28. Govindan, K., Rajeev, A., Padhi, S. S., & Pati, R. K. (2020). Supply chain sustainability and performance of firms: A meta-analysis of the literature. *Transportation Research Part E: Logistics and Transportation Review*, *137*(1), 1-19.
29. Gupta, H., Kusi-Sarpong, S., & Rezaei, J. (2020). Barriers and overcoming strategies to supply chain sustainability innovation. *Resources, Conservation and Recycling*, *161*(1), 1-18.
30. Hart, S. L. (1995). A natural-resource-based view of the firm. *Academy of management review*, *20*(4), 986-1014.
31. Hart, S. L., & Ahuja, G. (1996). Does it pay to be green? An empirical examination of the relationship between emission reduction and firm performance. *Business strategy and the Environment*, *5*(1), 30-37.
32. Hart, S. L., & Dowell, G. (2011). Invited editorial: A natural-resource-based view of the firm: Fifteen years after. *Journal of management*, *37*(5), 1464-1479.
33. Hishan, S. S., Khan, A., Ahmad, J., Hassan, Z. B., Zaman, K., & Qureshi, M. I. (2019). Access to clean technologies, energy, finance, and food: environmental sustainability agenda and its implications on Sub-Saharan African countries. *Environmental Science and Pollution Research*, *26*(16), 16503-16518.
34. Indrawati, S., Miranda, S., & Pratama, A. B. (2018). Model of warehouse performance measurement based on sustainable warehouse design. 4th International Conference on Science and Technology (ICST), Yogyakarta, Indonesia.
35. Khan, S. A., Kusi-Sarpong, S., Arhin, F. K., & Kusi-Sarpong, H. (2018a). Supplier sustainability performance evaluation and selection: A framework and methodology. *Journal of cleaner production*, *205*, 964-979.
36. Khan, S. A., Kusi-Sarpong, S., Arhin, F. K., & Kusi-Sarpong, H. (2018b). Supplier sustainability performance evaluation and selection: A framework and methodology. *Journal of Cleaner Production*, *205*(1), 964-979.
37. Kothari, C. R. (2004). *Research methodology: Methods and techniques* (2nd ed.). New Age International.
38. Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and psychological measurement*, *30*(3), 607-610.
39. Kusi-Sarpong, S., Gupta, H., & Sarkis, J. (2019). A supply chain sustainability innovation framework

and evaluation methodology. *International Journal of Production Research*, *57*(7), 1990-2008.
40. Le, T. (2020). The effect of green supply chain management practices on sustainability performance in Vietnamese construction materials manufacturing enterprises. *Uncertain Supply Chain Management*, *8*(1), 43-54.
41. Pinsonneault, A., & Kraemer, K. (1993). Survey research methodology in management information systems: an assessment. *Journal of management information systems*, *10*(2), 75–105.
42. Ranganathan, P., Pramesh, C., & Aggarwal, R. (2017). Common pitfalls in statistical analysis: logistic regression. *Perspectives in clinical research*, *8*(3), 148.
43. Raza, J., Liu, Y., Zhang, J., Zhu, N., Hassan, Z., Gul, H., & Hussain, S. (2021). Sustainable Supply Management Practices and Sustainability Performance: The Dynamic Capability Perspective. *SAGE Open*, *11*(1), 1-23.
44. Saunders, M., Lewis, P., & Thornhill, A. (2009). *Research methods for business students* (6th ed.). Pearson education.
45. Sekaran, U., & Bougie, R. (2016). *Research methods for managers: a skill-building approach* (7th ed.). John Wiley & Sons, Inc.
46. Shafiq, A., Johnson, P. F., Klassen, R. D., & Awaysheh, A. (2017). Exploring the implications of supply risk on sustainability performance. *International Journal of Operations & Production Management*.
47. Torabizadeh, M., Yusof, N. M., Ma'aram, A., & Shaharoun, A. M. (2020). Identifying sustainable warehouse management system indicators and proposing new weighting method. *Journal of Cleaner Production*, *248*(1), 1-12.
48. Wang, M., Asian, S., Wood, L. C., & Wang, B. (2020). Logistics innovation capability and its impacts on the supply chain risks in the Industry 4.0 era. *Modern Supply Chain Research and Applications*.