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Editorial Note

I am pleased to introduce the "***South Asian Journal of Operations and Logistics***" *(SAJOL)*, a rapid peer-reviewed Journal under SAG Publishing. We have been started in the year 2022 and are growing continuously. We are pleased to announce that our first issue has been published online on time. All published articles in this journal are included in the indexing and abstracting coverage of various scientific databases. The submissions to the journal are subjected to the peer review process by the editorial board members or external subject experts. The complete editorial processing of the manuscript is done through the SAG Publishing submission system for greater transparency and faster article throughout. During this calendar year 2022, Editorial Board and Advisory Board comprise prominent expert Editors and Reviewers who joined *SAJOL* and contributed their valuable services to the journal's quality.

I would like to express my gratitude to all the authors, reviewers, the SAG publishing, Managing Editor, and the Editorial Advisory Board of *SAJOL*. With their support, we have released Vol. 1 and Issue 2 for the calendar year 2022. We look forward to bringing out the next issue in June 2023.

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Importance of Green Supply Chain Management in Hospitality Business

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ABSTRACT

Customers' rising demand for hygienic and sustainable food products and increasing local and international competition in the hospitality industry have transformed the industry. The focus of the research study is to determine the existing position of the Pakistani hospitality industry and the relevance of Green Supply Chain Management (GSCM), and its impact on firm performance. The focus on the sustainable and green supply chain in the hospitality industry is a hot topic. Businesses can effectively manage the practices and procedures to achieve competitive advantage and economic benefits. The study incorporates a quantitative research design focused on deriving insights into the possible relationship and impact of the GSCM factors on the performance of Pakistani hospitality businesses. The sample size for the research is 150 participants, including people from management positions in different restaurants in Karachi, Pakistan. The findings from the research help to identify that GSCM is a critical part of a firm's strategic objective in Pakistan as the application of green purchasing, customer relationship management and eco-friendly product designs are found to have a weak to a moderate yet significant impact on the performance. The outcomes derived from the literature review help to identify that applying the policies related to mentioned factors helps offer a significant strong impact on businesses in the manufacturing and service industry. The results for the Pakistani industry show that waste management does not have any significant impact on performance which shows a contradictory outcome compared to the literature findings. The research also provides focused implications and future recommendations for businesses and research improvements.

Keywords: *Sustainability, Tourism, Pakistan, Green purchasing, Waste management, Eco-friendly, CRM*

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Importance of Green Supply Chain Management in Hospitality Business

1. Introduction

The hospitality sector is considered to contribute significantly to the economy. It allows to offer employment and generates economic profits that lead to an increase in the overall economic activity. The industry is majorly competitive as global hospitality businesses are expanding to new markets that have resulted in to increase in the local competitive landscape due to globalization. The increasing demand for sustainable and hygienic food products and services is also found to expand in the current time as customers are willing to consume more natural and sustainable food products (Baloch & Rashid, 2022; Modica et al., 2020; Uddin, 2022; Ayaz, 2022). Green, also known as sustainable supply chain management, is found to be a transparent, strategic achievement through the integration of a business's environmental, social, and economic objectives with focused internal organizational processes to sustain long-term performance both for the firms as well as the partners in the supply chain (Alam, 2022; Asif, 2022; Marwad & Zagade, 2020). Green supply chain management requires businesses to ask the stakeholders, including distributors and suppliers, to effectively deliver the products in transportation, manufacturing, and adopting sustainable practices and green solutions to save money and optimize functioning. The research by Miroshnychenko et al. (2017) helps to identify that environmental responsibility for businesses is a significant part of sustainable development with a primary emphasis on ecological sustainability. Companies are attracted to adopting green practices to reduce the overall environmental impact and to effectively improve their financial performance (Miroshnychenko et al., 2017; Wang et al., 2013; Victory et al., 2022; Hunaid et al., 2022; Ali, 2022).

The previous research findings help identify a significant role of hospitality businesses in the overall economic development and growth of a region. Also, it is determined that overall competition within the global context has increased with increased globalization. Local businesses cannot effectively compete with international businesses based on their size and focused strategic and sustainable practices (Anwar, 2022; Amjad, 2022). The studies show a need to focus on sustainability and GSCM as it can not only lead to improved operational efficiency but a positive impact on cost reduction, customer satisfaction, and the ability to enhance a business's reputation. Businesses worldwide can avail of the mentioned benefits and compete more effectively globally. Local businesses must focus on adopting and effectively managing GSCM as it can fulfil the increased customer demands and effectively increase the chances of survival in the market (Basit, 2022; Muzammil, 2022; Rasheed, 2022). The focus of the study is to highlight the relevance of Green Supply Chain Management (GSCM) to the performance of the hospitality industry in Karachi, Pakistan.

1.1. Purpose of the Study

The main motive/ purpose of the study is to determine the importance of Green Supply Chain Management (GSCM) in the hospitality industry in Pakistan.

1.2. Research Questions

The research questions for the study are;

a. *To what extent does green purchasing influence firm performance?*

b. *To what extent do waste management activities influence firm performance?*

c. *To what extent do eco-friendly designs influence firm performance?*

d. *To what extent does effective CRM influence firm performance?*

2. Literature Review

2.1. Theories and Models

There are various viewpoints related to deriving the motivation for businesses to focus on Green Supply Chain Management for businesses. The "System Theory" theory put forward a narrative that the business is a combination of different and complex systems. It must ensure to align the activities and processes to optimize the system's output (Karanovic et al., 2021). Businesses must ensure that all the activities are performed and carried out using effective waste management, supply chain efficiency, and others to enhance customer relationships (Sucky et al., 2019).

The demand for sustainable and green practices is also an essential requirement from the stakeholders and majorly from the customers. The businesses are required to effectively ensure the business's prospects and activities to ensure the lowest level of negative or no impact is evident and long-term effective operations are maintained (Julong, 1989). On the other hand, the organization theory is found to be influenced by various disciplines and helps to highlight the role of balancing the different aspects of the supply chain (Hatch, 2006). The organizational theory allows the development of an understanding related to the management's focus on maintaining adequate progress toward green supply chain management to enhance overall outcomes for the business and attain higher customer satisfaction (Sarkis et al., 2011).

2.2. Empirical Justifications

The section allows the summary of past literature to understand how the subject has been discussed. The focus of the literature review is to offer better insight based on the research questions. Therefore, the focus on highlighting the previous research on determining the impact of green purchasing, waste management, eco-friendly design of products and services, and maintenance of effective customer relationships are discussed with a focus on the performance of businesses operating in the hospitality industry. The analysis of research studies helps to determine that the focus of businesses on maintaining effective supplier relationships in terms of efficient and quality raw products and supplies has witnessed an increasing trend. The factor known as "Green Purchasing" plays a vibrant role in ensuring sustainable and effective planning toward workable long-term solutions. Research studies help to understand that businesses are required to effectively maintain internal management practices and policies to support organizations' performance. The effectiveness is critical as it allows businesses to overcome possible internal and external factors and challenges (Khan et al., 2017). Criticisms are also highlighted for the support of sustainable practices as these are found to have a direct negative impact on the performance of businesses. According to Khan and Qianli (2017), the focus on maintaining environmental strategies leads to increased investments that do not majorly add to the profits/performance of the business (Khan & Qianli, 2017).

The other studies show the significant importance of environmental strategies, which cannot be ignored in the current dynamic and competitive corporate environment. A study by Desire et al. (2019) helps to raise awareness regarding the relevance of green purchasing as the researchers proclaim that significant positive and inclining trend for sustainable business is noticeable, which is beneficial to enhance the overall long-term performance (Desire et al., 2019). Green purchasing is linked to purchasing and procuring sustainable products and raw materials. The effective development of green products is also included in applying green purchasing. Organizations are found to contribute more positively to limiting environmental impact and are relatively more significant and vital for businesses focused on manufacturing (Bassi et al., 2017). The relevance of green purchasing for enhanced customer satisfaction is also recognized in the literature. Therefore, businesses are more likely to achieve a better and more competitive market position which can lead to improvements in performance (Schmidt et al., 2020).

The relevance of green supply chain management is essential for businesses to limit waste and effectively maintain higher brand awareness and reputation. The relevance of waste management

activities and initiatives for manufacturing and servicing businesses are discussed to impact economic profits positively. The overall quality improvement for products and services is also witnessed and evident in literature (Bassi et al., 2017). The scholarly research further helps to highlight that business' efficiency and relative productivity are also found to increase positively. The global and internal/ local competitive landscape can be effectively dealt with, and higher performance can be achieved for businesses. Effective management and control can be further enhanced by efficiently carrying out waste management activities. Researchers show that waste products and others that can potentially harm the environment must be avoided and strict policies and monitoring must be carried out to limit the spread. Businesses with dynamic and ever-changing customer and corporate needs are required to efficiently fulfil the environmental, social, and economic goals and objectives. The effective utilization of waste management activities by businesses is also found to positively affect the business's productivity, efficiency, and growth (Schmidt et al., 2020). The focus on maintaining effective waste management can increase quantity as less raw material is wasted and the quality of products for businesses that are supposed to increase the possibility of growth/ future profits. The company's internal and external stakeholders expect the business to progress smoothly and focus more on achieving higher environmental outcomes.

Rashid and Rasheed (2022) argued that the effectiveness of waste management by businesses could contribute positively to productivity and higher performance. Waste reduction can facilitate internal efficiency and improve processes. Further, the management of businesses is required to more efficiently control and focus on maintaining a higher level of efficiency in maintaining product and service quality (Agyabeng-Mensah et al., 2020). A research study by Trivellas et al. (2020) helped to determine that consistency in operations is a must to fulfil quality issues and that the effectiveness of supply chain-related consistencies can lead to higher efficiency, consistency, and customer satisfaction (Trivellas et al., 2020). The research shows that focusing on environmental safety is a primary concern and objective for manufacturing businesses. This challenge and concern are gaining importance for all industries and businesses worldwide. The development of green purchasing and effective waste management has led to a relatively higher focus for businesses, not only for manufacturing businesses, to consider the use and application of eco-friendly product designs (Kim et al., 2019). The business's management must be proactive and consider the factor as a significant concern and directly impacting customers. Other stakeholders can be gained with effective management of product and service designs. Applying eco-friendly designs is also essential to establish a highly competitive business environment and is expected to enhance overall competitiveness.

Research shows that due to the significant environmental impact of combustion cars, businesses, including all current manufacturing businesses, and Tesla emerged with a motive to limit the environmental impact. The improved environment protection with due efficiency and afterwards electric cars can be considered the most efficient shift of businesses towards eco-friendly design. The eco-friendly product designs and other features have helped decrease the impact of human-related environmental challenges and enhance overall sustainability. The reduction of waste, carbon emission, and use of fossil fuels are expected to be efficiently managed by businesses with focused policies and strict rules and regulations to ensure that a higher level of efficiency and improvement can be evident. The focus of businesses on Corporate Social Responsibility (CSR) and practical, sustainable supply chain initiatives are considered most important (Firat, 2019; You et al., 2020). Research also helps to extract that consistency, and more sustainable business practices are required to most efficiently overcome and carry out long-term sustainability and other environmentally friendly objectives of the businesses (You et al., 2020). Furthermore, the research shows that "Customer Relationship Management", also referred to as CRM for businesses, is considered to play a vital role in improving the overall performance of the businesses. Soltani et al. (2018) help highlight that CRM is considered to help businesses stay more focused on approaches to improve customer satisfaction and remain highly competitive. The factor of competitiveness for businesses with higher customer satisfaction is majorly in the form of economic profits, increased revenues, and positive word of mouth (Soltani et al., 2018).

The application of new technologies and online customer interactions are found to positively affect supply chain outcomes and can lead to improved processes and efficient working (Soltani et al.,

2018). The increasing competitiveness has resulted in firms more effectively reaching customers, knowing about their preferences and needs, and further providing tailored products and services. Afterwards, the focus on continuous improvements is also considered critical as changes in customer behaviour, and requirements are noticeable. The relevance of customer feedback for businesses is highlighted in research as a critical part of developing a long-term relationship between the company and customers. There is a higher probability that firms can effectively meet and further improve the quality of the products with consistent feedback (Foltean et al., 2019). Research studies also help to determine the positive impact of effective customer relationship management and the performance of firms (Firat, 2019). The main objective for businesses is to ensure that product development and improvements are based on customer feedback and requirements. The role of management is again considered critical for customer relationships as the management's interest is reflected in the CRM. The effective use of CRM can lead to improving customer and business engagement, effective development of long-term relationships, enhanced engagement, and improved CSR outputs (Alshura & Assuli, 2017). Customer relationship management for businesses is also termed and considered as a procedure to efficiently and effectively accomplish overall organizational objectives/ goals. It is also considered necessary to effectively spread awareness of the business's efforts towards sustainable practices to achieve customer attraction.

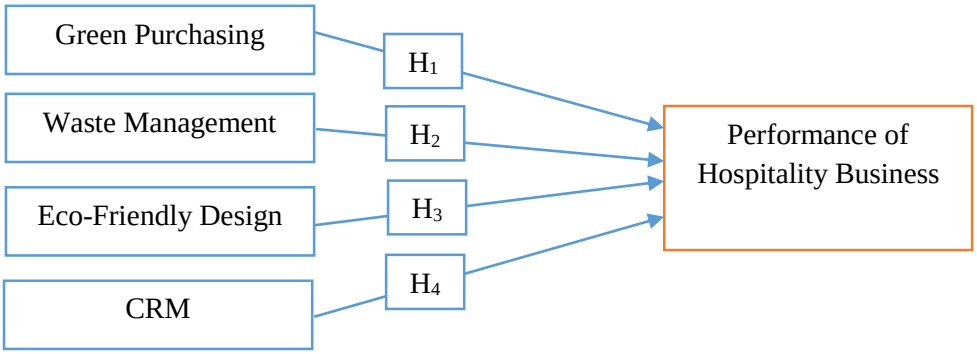

Figure 1: A research framework

2.3. Hypothesis

Based on the above-provided research framework, the following research hypothesis are provided. The research hypothesis for the study are;

H_1: Green purchasing significantly impacts the performance of hospitality businesses.

H_2: Waste management activities significantly impact performance.

H_3: Eco-Friendly product and service designs have a significant impact on performance.

H_4: Customer Relationship Management (CRM) impacts performance.

3. Research Method

The research methods section help to reflect and provide justifications for the methods applied to the research to accomplish the research objectives (Ragab & Arisha, 2018; Saunders et al., 2019). The focus is to provide a clear picture to the audience of how the data is to be collected, stored and processed to reach conclusions. The research approach selection includes the deductive or inductive research approach. The deductive approach is adopted for the study. This approach allows to derive research hypotheses based on existing theory and empirical justifications and carry out more systematic and comprehensive outcomes for the phenomenon, subject, and topic (Saunders et al., 2019). The study is devised based on the implications of GSCM in hospitality businesses therefore, previous research is summarized and findings from theoretical perspectives are identified. The different aspects of GSCM,

including waste management, green purchasing, eco-friendly design, and customer relationship management, are to be analyzed concerning the performance of the business. The initial insights about the interrelationship are discussed in the literature review, and hypotheses are developed to specify the direction and identify the possible outcomes.

3.2. Research Design

The research design in the methodology section reflects the overall plan devised to answer the research questions. The most suitable research design is identified so that a reliable and relevant study can be conducted. The cross-sectional research design is selected as it allows for selection and collects data from different individuals at a single point in time (Hashmi et al., 2020; Khan et al., 2022a, b, c; Spector, 2019). The researcher selects individuals, including managers, supervisors, and owners of different hospitality businesses, including (hotels and restaurants) in Karachi, Pakistan these people are inquired about the application of GSCM and its relevance for business performance. The significant benefits of adopting a cross-sectional research design are that it allows testing or approving/disapproving assumptions, is cost-effective, allows for the specification of the variables, and collects data from a variety of participants, and the data collected can be used for different research purposes.

3.3. Sampling Design

The sampling design reflects the procedure to define and select the sample size. It is considered a critical part of the research and allows to most efficiently reach conclusions (Hashmi et al., 2020a, b; Khan et al., 2021; Lohr, 2021). The focus of the research, as highlighted above, is to determine the impact of different GSCM factors on firm performance and participants, including individuals who are aware of the concepts, are to be selected to answer the questions (in the online questionnaire). The researcher, therefore, from the sample specifies the participants including managers, executives, supervisors, and owners of the businesses working in the hospitality industry. The research is to identify the impact of GSCM on firm performance. Therefore the sample includes professionals that can quickly answer the research questions from the organizational viewpoint. Also, the researcher focuses on businesses, including restaurants and hotels. The application of the purposive sampling technique is adopted; the sapling technique allows to specify of the participants based on the researcher's assumptions, including managers, supervisors, and owners of restaurants and hotels in Karachi. The focus is to ask questions from participants who can effectively answer them; therefore, more focused and reliable outcomes can be derived from the study. A sample size of 150 participants is selected to represent the outcomes for all the management personnel working in hospitality businesses in Pakistan (Rashid et al., 2021; Hashmi et al., 2020b; Hashmi et al., 2021a, b).

3.4. Data Collection

The data is collected using a survey questionnaire. Data collection allows for better identification of the overall procedure used by the researcher (Rashid et al., 2019). The researcher selects participants through visits to hotels and restaurants and informs the management about the motive and relevance of the subject and research. After their consent is gained, the link to the online questionnaire is provided to the management personnel. The data in numerical values were coded (5 scale Likert scale responses). The Likert scale chosen includes options 1-Strongly disagree, 2-Disagree, 3-Neutral, 4-Agree, and 5-Strongly agree (Rashid, 2016; Agha et al., 2021; Haque et al., 2021; Das et al., 2021; Alrazehi et al., 2021).

3.6. Statistical Technique

Using quantitative data sources allows the researcher to conduct a detailed statistical analysis using SPSS to test and answer the research hypothesis. The tests applied on SPSS include reliability statistics, frequency distribution, and regression analysis (Rashid & Amirah, 2017). All the tests are applied based on their effectiveness to assess and analyze the data and provide effective outcomes. The

focused statistical techniques were selected based on their relevance and ability to achieve the outcomes required by the researcher.

3.6.1. Reliability statistics

The application is vital as the responses and their overall reliability and validity are tested and presented (Hinton et al., 2014; Pallant, 2020). The researcher applies the initial test as the validity can be effectively identified from the test. The motive is to identify whether the responses collected present valid and consistent outcomes or not (Rashid et al., 2020).

3.6.2. Frequency distribution

The test allows assessing the frequencies/ summary of the significant data source, including responses from 150 participants. The motive is to present a summary of the data so that the audience knows the overall participation and outcomes in the form of tables and charts for respective questions (demographic and investigative questions) (Mills, 2014; Hinton et al., 2014).

3.6.3. Regression

The application of regression is made to ensure that the possible impact of the independent variables on the dependent variable is identified and presented to answer the research questions/ test the research hypothesis and reach conclusions (Kafle, 2019). The test is applied as it can effectively help determine the impact of the independent variables on the study's dependent variable (Hinton et al., 2014).

4. Results and Findings

4.1. Reliability Test

The importance of reliability tests for the survey questionnaire is essential. The understanding derived from the reliability test is vital to reflect the consistency and accuracy/ reliability of the responses collected by human participants. The reliability statistics for the current study are carried out for the total 150 responses collected for 25 items (questions five each for independent variables (CRM, Eco-friendly design, waste management, and green purchasing = 20) and five questions for performance (dependent variable). The value of Cronbach's Alpha is critical as it reflects the overall reliability of the responses. The results from the table show that a value of 0.898 is achieved which is greater than the standardized value of reliability (Cronbach’s alpha) of .70 (Rashid & Rasheed, 2022; Ahmad & Ahmad, 2018). Therefore, it can be concluded that the reliability score identified/ evaluated reflects a higher reliability value and further assessment and analysis can be carried out.

4.2. Demographic Profiles

The demographic details for the respondents are tested under the frequency distribution to highlight the frequency and percentage value. The results for age helped to identify that 63 participants (majority) have ages between 31 and 35 years and 38 between 20 and 25 years. Furthermore, 27 participants were aged between 31 and 35, and 22 were above 36. The participation of male and female respondents in the questionnaire was effective as 78 males, whereas 72 female participants participated in the questionnaire. The research results show moderate to higher female inclusion in the hospitality industry. The participants taking part in the research have an excellent educational background, with 71 postgraduate degree holders, five graduates, and 25 with other qualifications/ degrees. Finally, results show that 21 participants have experience have ten years, 47 with 4 to 6 years of experience, 45 with 1 to 3 years, and 37 with experience between 7 and 9 years.

4.3. Hypothesis Testing

The hypothesis of the research is tested using regression analysis. The performance of the hospitality businesses and the average of the related questions are treated as the dependent variable. In contrast, the independent variables for the study include green purchasing, waste management, eco-friendly designs, and customer relationship management. The motive is to derive insights regarding the impact of green purchasing, waste management, eco-friendly product design, and customer relationship on the performance of the hospitality industry. The outcomes from the research allow us to reach the outcomes better and better compare the results with existing literature.

Table 1: Regression outcomes

Variables	N	μ	St. Dev	Model Summary		ANOVA		Coefficient		
				R	R^2	F	Sig.	Std. Beta Coefficient	T	Sig.
Green Purchasing	150	3.116	.566	.767	.589	51.855	.000	..236	2.314	.022
Waste Management		3.139	.562					-.158	-1.77	.079
Eco-Friendly Design		3.157	.524					.529	5.46	.000
CRM		3.175	.595					.229	2.520	.013
Performance		3.21	.567							

The regression output presented in table 1 illustrates the variables entered in the regression model. The independent variables presented under the "variables entered" our Customer Relationship Management (represented as CRM), Waste Management (WM), Eco-friendly Design (EFD), and Green Purchasing (GP). The model summary identified the relationship between the variables tested in the regression analysis. The value of R Square is critical and is reflected to be 0.589 (58.9%), which shows that the increase in independent variables or any one of them can influence the business's performance positively. The results, in other words, can be interpreted as the increase in CRM, WM, EFD, and GP for hospitality businesses is expected to have a positive impact meaning that the increase would result in improvements to the business performance. The significance value is interpreted to assess the significance of the relationship further. The results show that a $0.000 < 0.05$. Based on the outcomes from the regression, the conclusion can be drawn that the increase in focus and activities, including customer relationship management, waste management, eco-friendly design for products, and green purchasing by the hospitality business, is expected to raise profitability and performance

.

The coefficient values are interpreted to assess further the independent variables' separate relationship and impact on the dependent variable (performance). The focus of the interpretation is to test the research hypothesis. The outcomes from the table (Coefficients), including unstandardized coefficients B (Beta) and sig., are most important as Beta shows the degree of impact of the independent variables on the dependent variable, whereas the sig. It should be less than .05 to reflect a significant relationship between the variables. The results shown in the table help to identify that the independent variable GP (Green Purchasing) is found to have a significant (Sig. = .004) and weak positive impact on the performance of the hospitality businesses (Beta = .236 (23.6%)). Moreover, the research findings help to identify that waste management for hospitality businesses does not have any significant impact on the performance of the businesses (Sig. = .079 (i.e., greater than .05)). The Beta value shows a negative impact as -.158 value is reflected. The results can be interpreted that there is a negative weak yet insignificant impact of waste management practices on the performance of hospitality businesses.

EFD (Eco-friendly Design) outcomes help identify a moderate positive relationship, and the significance value of .000 is achieved. The results help to identify that the increase in the effective eco-friendly design of the products and services for hospitality businesses is likely to positively/ improve the performance of the hospitality businesses. The final hypothesis is to test whether CRM (Customer Relationship Management) significantly impacts the performance of businesses. The findings from the table (Coefficient values (from the regression table)) help to identify that the improvements in customer

relationship management by hospitality businesses are expected to positively and weakly lead to improvement in business performance. The increase in performance due to the increase in CRM activities and initiatives is found to be 22.9% (i.e., 0.229). The results from the regression analysis help to identify that the hypothesis is tested, and the respective answers/ results are provided in the table in the section below.

4.4. Hypothesis Assessment Summary

The statistical analysis results focus on determining the effect of the independent variables on the dependent variable. The results are expected to provide better insights regarding the factors that are important for the Pakistani hospitality industry/ businesses and what must be done to improve the businesses' performance further. The results help to identify a significant and positive weak impact of Green Purchasing on the performance of hospitality businesses. The weak relationship signifies that in the future, more focused approaches to green purchasing by Pakistani hospitality businesses can be applied to define better and signify the outcomes. From the current perspective, it can be concluded that the alternate hypothesis (Hypothesis 1) is accepted.

The second hypothesis for the research is focused on determining the impact of waste management on the performance of hospitality businesses. The results from the statistical analysis (regression) show that the focus on increased waste management is found to have a negative, weak and insignificant impact on the performance of the hospitality industry. The results can lead to conclude that the alternate hypothesis for the study is rejected (i.e., Waste management activities significantly impact performance). The impact of the eco-friendly design of the products and services offered by the hospitality industry/ businesses is reflected to have a significant and moderate impact on the performance of the businesses. The results can lead to conclude that the firms are required to focus more on developing and designing eco-friendlier designs to better convey their focus on green supply chain management to the stakeholders and achieve better performance/ outcomes. It can be stated that Hypothesis 3 is accepted as a positive and moderate significant impact identified through the analysis. The last hypothesis deals with the determination of relevance and impact of customer relationship management in hospitality businesses and whether it impacts significantly on the performance of the businesses. The results show that the increase in customer relationship management can lead to a weak impact (22.9%) on increasing the performance of the businesses. The null hypothesis (Hypothesis 4) is accepted based on the results. The outcomes derived from the interpretation of the regression analysis are presented in the table below.

5. Conclusion

The focus of the research was effectively carried out using a detailed assessment of past literature and comparing it with the findings derived from quantitative analysis in the research. The focus of the quantitative research is to test the hypothesis and better understand how the GSCM and related activities in the Pakistani hospitality industry are found to impact the overall performance. The results help to identify a positive weak, and significant relationship between green purchasing and the performance of hospitality businesses. Furthermore, the results show that customer relationship management has a significant but weak impact on performance. The results derived from the past studies help to raise a concern that globally the application of green supply chain management in hospitality and other industries leads to an effective and strong impact on the performance of the businesses.

The findings from the study also show that waste management activities are not found to have a significant impact on performance which is contradictory to the primary research findings. Finally, the results help to identify that eco-friendly product designs are found to have a moderate impact on firm performance in hospitality businesses. The overall results can help to conclude that the importance of GSCM in Pakistani perspectives has shown a considerable increase as the professionals have highlighted and results have confirmed that the improvements in GSCM activities and initiatives for businesses lead to moderately impact the performance. Customer satisfaction is also raised in the

literature review to be a significant factor in why businesses focus on such initiatives.

5.1. Discussion

The section is focused on offering a comparative analysis of the findings derived from quantitative analysis and literature review. The focus is to reach the answer to research questions with a detail of what is achieved from the current analysis and how the results are supported or negated by the past researchers. Results suggested that the green supply chain management and related activities of the business, including green purchasing, waste management, development of eco-friendly designs, and customer relationship management, have a strong relationships with performance. The past research also helps to derive the insights that Green purchasing significantly impacts firm-level strategic planning. The focus of the business is to ensure that internal capabilities and effectiveness towards sustainable procedures and processes can be effectively managed (Khan et al., 2017). The findings of the research allow determining that a positive. However, the weak impact of green purchasing is evident in Pakistani hospitality businesses, contrary to the findings from the literature review.

The research outcomes derived from the literature review help identify the strong impact of green purchasing initiatives on the businesses found on firm performance both in the short and long run (Desire et al., 2019). The research studies also highlight that the increasing adoption and application of green purchasing leads to sustainable purchasing and is considered a practical step towards producing green products and services for hospitality businesses (Bassi et al., 2017). Researchers also highlight the importance of green purchasing on improved customer satisfaction, which can lead to better competitive and economic/ performance benefits in the long run (Schmidt et al., 2020). Based on the discussion, the results help to identify that the respondents, including management personnel, are not fully aware of the benefits of green purchasing. Therefore, there is a need to increase awareness among the public as well as businesses at large.

According to the respondents, the waste management practices for businesses do not have a significant impact; moreover, a negative relationship between WM and performance is evident from the regression outcomes (Beta -0.158 weak and adverse with Sig.= .079 insignificant). The literature review highlights that businesses in the hospitality industry and others must carry out waste management and sustainable supply chain practices most efficiently. The study by Sucky et al. (2019) help to highlight that waste management in restaurants and the hospitality industry significantly leads to improved customer relationship and satisfaction. Researchers also highlight that the application of waste management strategies by businesses is found to have a significant positive impact on the manufacturing and service industry's performance and profitability (Bassi et al., 2017).

The requirement to efficiently control and maintain sustainability can be managed most effectively by carrying out waste management effectively. Researchers highlight that the practical application of waste management for businesses can improve efficiency, productivity, and growth (Schmidt et al., 2020). The research results determine that eco-friendly design for businesses is found to be the most critical and leads to a moderate impact on firm performance. The past research studies also help to identify that applying sustainable and green supply chain management practices aims to reach eco-friendly and effective product and service designs (Kim et al., 2019). The research allows the development of an understanding that improved and eco-friendly products and designs for businesses can increase customer satisfaction and demands for the business's products and services (Firat, 2019; You et al., 2020).

The focus on eco-friendly product designs helps businesses use sustainable raw materials that attract new customers and helps retain current hospitality business customers (Firat, 2019; You et al., 2020). For Pakistani hospitality businesses, the relevance of eco-friendly design and products is gaining importance; however, application to the industry is required. The results also show that effective customer relationship management for hospitality businesses shows a positive weak, and significant impact on the performance of the businesses (Beta value of .229 and sig. = .013). The findings derived from the literature review also support that customers worldwide require more hygienic and sustainable

food products (Shaheen, 2022; Modica et al., 2020).

The application of GSCM provides efficient outcomes for businesses to overcome challenges and effectively meet customer demands for hygienic and sustainable products and services (Sucky et al., 2019). The effectiveness of customer relationships for businesses and their impact on improving customer satisfaction and business performance are pointed out by Sucky et al. (2019). The findings derived by Sarkis et al. (2011) also help to support the results that customer satisfaction can be improved by effectively applying GSCM practices, which leads to better performance. Schmidt et al. (2020) also help to highlight that businesses are required to effectively manage customer relationship management practices to improve the overall outcomes.

5.2. Implications and Limitations

The results identify a significant and moderate impact of all the independent variables reflecting the relevance of Green Supply Chain Management. Based on the findings, it is required that all hospitality businesses focus on raising their GSCM standards as it can improve customer satisfaction, lower the environmental impact, improve waste management, and finally, can result in better performance of businesses. Research limitations for the research are limited as the focus was to achieve a better and more detailed understanding of the subject using the resources. The researcher was able to achieve a significant sample size (i.e., 150) however, access to the management personnel was a significant concern as the businesses had limited upper management staff compared to employees and staff. The research made sure to reach out to more restaurants in Karachi to collect responses that can provide better outcomes. The data collection process took more time than anticipated. However, the research outcomes are found to be effective and efficient.

5.3. Recommendations

Based on the outcomes of the research, the following recommendations are offered. The hospitality industry must decide and effectively adopt GSCM as it is found to positively influence the performance of businesses (Desire, Mulyungi, & Ismail, 2019). The main motive of the firms is to offer products and services that can meet the changing demands and satisfy the customers at large. Therefore, the application of GSCM is recommended. The improvements in green purchase, customer relationship management and waste management activities and initiatives for the hospitality industry in Pakistan must be focused on. The results show a varied discussion as past research shows a significant and robust positive impact of the variables on firm performance (Schmidt et al., 2020). The importance in Pakistani businesses is required to rise with focused and strategic plans and developments. Finally, based on the results, future researchers are recommended to carry out more focused and in-depth research studies to derive better theoretical, practical, and conceptual outcomes for the subject. Applying interviews using qualitative research is highly recommended as it can offer a better outcome in gaining insights from professionals regarding the subject and reflecting on the why factors of their responses.

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Influence of Green Purchasing and Green Packaging on Sustainability and Operational Performance: A Case Study from E-Commerce Industry

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ABSTRACT

The increase in supply chain management concerns waste management, pollution, and others have led to a more concerned opinion from the stakeholders. Businesses all over the world are facing challenges in implementing processes and applying strategies in the long run to limit the overall environmental impact. The focus of the research is to develop a better understanding of sustainable supply chain management practices and to determine the relevance of SSCM with a focus on sustainability and performance. The subject's relevance is derived from understanding the sustainability and supply chain management theory, and focused hypotheses are developed. The researcher carried out a quantitative research methodology with a survey questionnaire designed and developed on Google Forms and was provided to the supply chain professionals in Karachi, Lahore, and Islamabad. The researcher collected a total of 153 responses based on the statistical analysis. The outcomes derived from the regression analysis allow us to understand that the application of green purchasing has no significant impact on the overall performance; however, a weak positive impact on the sustainability of the business is evident. However, sustainable purchasing is found to impact overall performance and sustainability positively.

Keywords: *Sustainability, E-commerce, Daraz, Green packaging, Green purchasing.*

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Influence of Green Purchasing and Green Packaging on Sustainability and Operational Performance: A Case Study from E-Commerce Industry

1. Introduction

The increasing concerns about Supply Chain Management (SCM) for most industries are evident (Hashmi & Mohd, 2020; Hashmi et al., 2020a; Lavastre et al., 2012; Vanalle et al., 2017). The processes lead to the creation of pollution and waste, threatening the overall well-being and existence of life (Zailani et al., 2012). The businesses are pressurized to focus on maintaining adequate consideration to limit the environmental impact of Supply Chain (SC) and business processes. Research by Carter and Jennings (2002) helps to highlight that businesses are required to effectively portray environmentally friendly processes, product design, technologies, systems, and ways of doing business (Carter & Rogers, 2008). The business environment is also impacted by the recent changes and developments in economic and climate uncertainty. It has pressurized businesses to restructure and reconstruct their organizational strategies to more sustainable practices to survive and compete effectively in the dynamic business world (Hutton & Cox, 2013). The global pressures are through media, stakeholders, standards prepared by the authorities, NGOs (non-Governmental Organizations), and the community. The businesses focus on developing and adopting sustainable practices and applying them to internal and external (suppliers) to effectively meet the customer's sustainability expectations (Porter & Kramer, 2006; Zailani et al., 2012). The study is carried out with a focus on identifying the relevance and adoption of sustainability in supply chain management practices for Daraz, Pakistan's first and largest e-commerce market established in 2012 (Owned by Ai Baba in 2018). The research study is devised to understand how the business has transformed over time concerning sustainability requirements and whether sustainable business practices have led to increased sustainability and operational performance.

The term Sustainable Supply Chain Management (SSCM) is referred to: The transparent, integrated, strategic, and achievement of social, economic, and environmental goals by effectively managing the inter-organizational processes to improve the processes, organizational, and economic performance of the supply chain (Carter & Rogers, 2008; Hashmi et al., 2020b). The preliminary research helps identify concerns for SCM businesses that have witnessed increasing debates. Researchers have helped to highlight that human life and its existence is majorly impacted by lack of sustainability (Vanalle et al., 2017; Hashmi et al., 2021a). External pressures are found to impact organizational decision-making. Therefore, considering integrating and effectively applying supply chain management activities and processes is discussed from a business perspective. The focus on Pakistani businesses is limited. However, most Pakistani businesses are adopting sustainability within the Supply Chain Practices (SCP) based on the increasing demand from customers and enhanced external pressures from media, NGOs, and other stakeholders. The focus of the study is to derive an investigation to determine the relevance and adoption of SSCM for Daraz, the largest e-commerce business in Pakistan (owned by Ali Baba). The research aims to carry out an in-depth investigation on the adoption of SSCM (Sustainable Supply Chain Management) and how it has helped Daraz to achieve higher company performance and overall sustainability effectively.

1.1. Research Objectives

The research objectives are developed to accomplish the research aim/ purpose effectively. The research objectives are;

a. To determine the association between green purchasing and sustainability.

b. To determine the association between green purchasing and operational performance.

c. To determine the association between green packaging and sustainability.

d. To determine the association between green packaging and operational performance.

1.4. Research Questions

The research question of the research is presented below;

a. To what extent does green purchasing influence sustainability?

b. To what extent does green purchasing influence operational performance?

c. To what extent does green packaging influence sustainability?

d. To what extent does green packaging influence operational performance?

2. Literature Review

2.1. Sustainability and Supply Chain Management

According to researchers, there is a significant role in sustainable supply chain management considered to be a major part of supply chain development. There are three core dimensions of sustainable development, including social, economic, and environmental prospects (Carter & Rogers, 2008). The focus of businesses to effectively meet the demand from customers has led to increasing the industrial output for which supply chain practices are increased leading to negative consequences for the society and environment. Therefore, sustainability's relevance in supply chain management is a majorly debated research topic (Rajeev et al., 2017). The findings from Rajeev et al. (2017) help to highlight that sustainability in businesses concerning economic, environmental, and social prospects are rare. However, one or combination of two dimensions is discussed in the research.

Other researchers help identify five major categories of high relevance and importance towards supply chain management. The relevance of sustainability, collaboration, continuity, proactivity, and risk management are the five factors to be focused on. The research studies must adopt a more conventional approach to supply chain management as it can lead to effective, sustainable supply chain management (Beske & Seuring, 2014; Hashmi et al., 2021b). The requirements for businesses to act sustainably are considered critical. The businesses must ensure to effectively assess the overall social impacts related to the supply chain activities as it can lead to effective competitive advantage. The focus of the management is to evaluate the different sustainable practices and methods must be determined before taking the decisions (D'Eusanio et al., 2019). The outcomes from previous research show that the individual dimensions for sustainable supply chain management for businesses are discussed in the majority. However, a more integrated approach to dealing with the subject is required.

2.2. Green Packaging

James et al. (2005) help to define that packaging without delay can contribute to the fulfilment of the product in the supply chain whereby it permits green distribution of merchandise and reduced environmental, intellectual effect of product spoilage and waste (James et al., 2005). However, packaging has an environmental impact that is not sustainable within the lengthy-time period, such as intake of non-renewable sources, the era of air emissions in production, shipping and use, and manufacturing of strong waste requiring disposal in landfills. According to Kooijmann (1996), the blessings of Green Packaging might be apparent from an environmental perspective, along with reduced waste and aid conservation, in addition to the monetary and social blessings (Kooijmann, 1996).

Verghese and Lewis (2007) argued that, typically, when goods bypass the commercial supply chain, the related packaging waste is usually a forgotten or omitted derivative that is poorly managed and sooner or later leads to litter, negative recycling, and pointless waste to landfill. These phenomena are further annoyed employing terrible communique and absence of experience of responsibility among delivering chain partners; which limits the capability for stepped forward packaging solutions that can concurrently meet the useful desires of the deliver chain's running surroundings and decrease the

environmental effect and supply chain costs (Verghese & Lewis, 2007). According to Jahre and Hatteland (2004), packaging plays an enormous position in a huge included device that entails many actors for the duration of the supply chain, such as substance managing, inbound logistics operations, buying, production, warehousing, transportation, and retailing (Jahre & Hatteland, 2004).

2.3. Green Purchasing

The businesses are focused on ensuring green purchasing as a sustainability strategy that effectively incorporates the sustainable activities right from the basics (Zhang et al., 2013). Businesses can effectively adopt these activities as a top priority. The product-related features are well explained and presented; furthermore, the application of effective communication between the suppliers, business, and customers are carried out. All the different activities and product attributes, including content requirements, content restrictions, labelling, and disclosures, questionnaires from suppliers, environmental management from suppliers, certification of the supplier(s), and compliance to audit for suppliers, are all effectively incorporated within the practices (Eltayeb & Zailani, 2014). The results help to identify the significant impact of green purchasing on maintaining effective relationships with the suppliers and customers.

Based on the above, delivery managers must recollect the final disposition of the materials and additives that input the firm (Eltayeb et al., 2021). Carter and Jennings (2002) recommended that those lifestyles-cycle issues need to be considered as part of the shopping and procurement procedure and ask upstream individuals of the supply chain to dedicate to waste reduction goals and to layout and offer the buying company the substances and components recognized via the layout for disassembly and lifestyles-cycle analysis (Carter & Jennings, 2002; Rashid et al., 2022). Bjorklund (2010) recommended that growing strategic importance of the shopping characteristic has elevated the dialogue at the contribution of shopping to lower the effect at the natural environment and concluded that purchasing may want to be a more powerful alternate agent than every other company characteristic (Bjorklund, 2010). Carter and Jennings (2002) claim that green purchasing has an extraordinary impact on a company's operational performance concerning net profits and the value of products bought (Carter & Jennings, 2002; Rashid & Rasheed, 2022). Zsidisin and Siferd (2001) provided a greater holistic definition of Green purchasing, which is likewise implemented in this study: Environmental searching for a character firm is the set of shopping regulations held, actions taken, and relationships fashioned in response to concerns related to the herbal surroundings (Zsidisin & Siferd, 2001). These issues relate to the purchase of uncooked materials, along with supplier choice, assessment and development, supplier's operations, in-bound distribution, packaging, recycling, reuse, resource reduction, and very last disposal of the firm's merchandise (Rezaei et al., 2016). Based on the above evaluation of the literature, green purchasing practices with the aid of manufacturing agencies can achieve a couple of advantages including greater dealer engagement, decreased fee and minimized environmental effect, that could eventually cause a sustainable deliver chain performance.

2.4. Research Framework

The research framework is devised to highlight the relevance of sustainable supply chain management, precisely focused on determining green purchasing and Green Packaging for Daraz. The overall sustainability dimensions determine the impact of sustainable practices. The focus of the research is to assess the factors, including green purchasing and Green Packaging for the products delivered to the customers, on the overall sustainability. The research outcomes are considered to contribute positively towards effectively determining the impact of green purchasing and Green Packaging on all the sustainability for Daraz and positively add to the literature gap (Zailani et al., 2012).

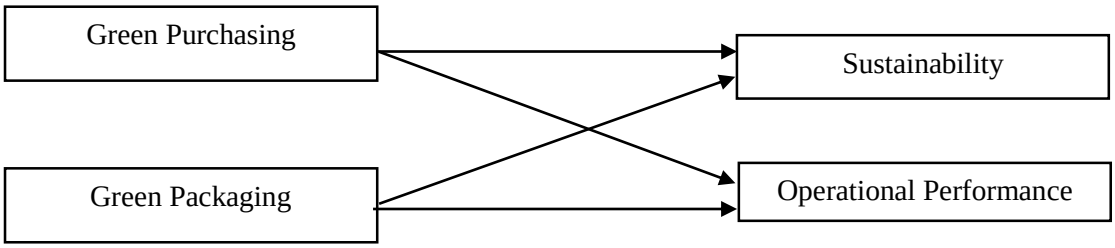

Figure 2: Framework of research

2.5. Hypothesis

The research hypothesis for the study is devised based on the determination of the impact of green purchasing on outcomes for the business. The researcher provides a more focused research hypothesis that is categorized from the central hypothesis, these include;

$H_{1\,(a)}$: Green purchasing significantly influences sustainability.

$H_{1\,(b)}$: Green purchasing significantly influences operational performance.

$H_{2\,(a)}$: Green Packaging significantly influences sustainability.

$H_{2\,(b)}$: Green Packaging significantly influences operational performance

3. Research Methodology

The research approach reflects on the possible procedures and plan, which incorporates the broad assumptions related to the data collection, practical analysis, and interpretation (Saunders et al., 2019). The focus of the research approach is to effectively determine the plan that fits the problem addressed in the research. The main research approaches include qualitative, quantitative, and mixed approaches. Qualitative research helps conduct a more naturalistic and in-depth inquiry about a subject. A detailed assessment is planned to be carried out to determine the reasons and how people perceive the subject (Grossoehme, 2014). Quantitative research integrates the adoption of methods that help to collect and analyze numerical data; it helps to provide details and patterns, test different causal relationships, and make predictions based on data (Bloomfield & Fisher, 2019). Finally, the mixed-method allows adopting a methodology incorporating qualitative and quantitative data and their analysis. The focus of the methodology is to provide focus on carrying out a detailed assessment of a subject/ phenomenon (Onwuegbuzie et al., 2010).

To determine the impact of SSCM, the study is focused on carrying out a quantitative research approach. The plan is to collect the responses on a self-administered questionnaire and convert the responses into numerical values (Likert Scale). Research design allows helping integrate and define the different parts/ components of the research to enhance the coherence and logic of the research (Marczyk et al., 2010). It allows us to effectively reflect on the procedures that can improve the chances of accomplishing the research objectives. The correlational research design is adopted. It allows for the development of research that determines the relationship between the variables without any control or manipulation. For the current study, the impact or relationship between SSCM and the performance of Daraz is to be evaluated. Therefore, the correlational research design fits the nature and direction of the research (Myers et al., 2013).

3.3. Sampling Design

The sample refers to a subset derived from the research population, which is focused on offering

convenience and ease to the researcher to carry out efficient research (Rashid et al., 2021). The sample size for quantitative research is more significant compared to qualitative research. The research population comprises the supply chain managers and executives working in Daraz Karachi, Lahore, and Islamabad. The researcher plans to reach out to the supply chain personnel working in Daraz and inform them about the motive of the research and how their contribution can help to improve the understanding and relevance of sustainable supply chain management in Pakistan's largest e-commerce business. The personal contacts, including friends, were informed that the respective supply chain department in two different locations in Karachi, Lahore, and Islamabad will be provided with the link to an online questionnaire the respective participants would fill. The sample size for the current study is 200 participants, including experienced executives, managers, and other supply chain management personnel working in the company's warehouse at different locations within Pakistan. The motive is to collect the responses code them into excel, and export them to SPSS for analysis purposes. The questionnaire was distributed to a total of 200 participants. Managers, executives, and other management personnel from the supply chain department will be selected and asked to fill out the questionnaire (Khan et al., 2020; Khan et al., 2022a, b, c).

3.4. Instrument of data collection

The instrument is planned to be circulated as an online questionnaire. The questionnaire is devised on MS Word and approved by the supervisor. Later Google Forms was used to develop and collect an online link circulated to the respondents. The questionnaire for the research is adopted from the study by (Zailani et al., 2012). The survey questionnaire constitutes two parts and is developed following the sample provided by the supervisor. The two parts/ sections include demographic details and other investigative questions. The demographic details, including the age of participants, gender, and experience with Daraz, are inquired about. It is ensured that no personal question is asked to increase the anonymity of the respondents. The questions are planned to be analyzed using descriptive statistics (frequency distribution). On the other hand, the second section of the questionnaire comprises five questions related to sustainable supply chain management, customer satisfaction, and the relevance of the two variables on the performance of the business. For performance, the questionnaire comprises five questions. After approval, all five questions and the demographic information would be added to the online questionnaire.

3.5. Data collection procedure

Data collection reflects the possible ways participants collect data (Couper, 2017). The researcher has asked two of his close friends about the research's relevance, objective, and aim. These two persons working as managers in Daraz have been allowed to provide them with the questionnaire, which was delivered/ sent to supply chain managers and other management personnel. An online questionnaire is used as it allows the opportunity to carry out the research without being physically present in Lahore, Islamabad, and even in the two Karachi-based warehouses of Daraz. The questionnaire is filled out using the online survey link on Google Forms. The participants can easily access and fill out the questionnaire using the internet as it does not require any specific tool or application.

3.6. Statistical Techniques

Statistical tools used for the study include AMOS and SPSS. In the application of Reliability statistics to test the reliability of the responses (Leech et al., 2014), the frequency distribution is used to determine the summaries of the frequency of the demographic details and help to develop a profile for the respondents (Meyers et al., 2013; Rashid, 2016; Rashid & Amirah, 2017). Finally, a regression analysis (Linear regression) is to be carried out to determine the impact of the independent variables, including the application of environmental packaging and Green Packaging by Daraz, on the performance and sustainability of Daraz.

4. Results and Findings

The analysis outcomes were derived from SPSS. The outcomes from SPSS include reliability testing, descriptive profile (demographic profile) for the respondents using frequency distribution and regression analysis (Rashid et al., 2019; Rashid et al., 2020).

4.1. Reliability Statistics

Reliability testing is carried out to determine the validity and consistency of the responses (data collected by the researcher). The total number of observations/ responses collected by the researcher is 153 responses, and all the responses are tested for 24 items (including 5 for environmental packaging, 5 for green packaging, 5 for operational performance, and 9 for sustainability). The results for Cronbach's Alpha are used/ interpreted to determine the reliability. The results derived from the reliability are based on the interpretation of Cronbach's Alpha. The value should exceed the standard limit of 0.70 to achieve reliable levels (Rashid et al., 2021; Agha et al., 2021; Haque et al., 2021; Das et al., 2021; Alrazehi et al., 2021). The reliability statistics table shows a value of 0.913 for 24 items, reflecting that the data collected for the research study are valid and reliable.

Table 1: Reliability statistics

Cronbach's Alpha	N of Items
0.913	24

4.2. Descriptive Profile

The focus of the section is to offer insight into the demographic details, including the gender, age, education, and experience of the respondents. The results are provided in the combined table and graphs that are interpreted to derive better insights from the findings of the descriptive profile. The table allows insight into the research study's audience about the number of responses against each item of the demographics. A detailed explanation for pie charts for respective outcomes is provided for a better understanding. The demographic results illustrated that most male respondents participated in the research. Out of the 153 respondents, 75.16% (115) are male. The remaining 24.84 (i.e., 38 respondents) are females. The age distribution for respondents in four categories (i.e., 20-29 years, 30-34 years, 40-49 years, and 50 or above years). The results help to identify that the respondents over 50 years were 0.7% (i.e., 1 participant). Fifteen respondents had an age between 40-49 years, 57 respondents between 30-39 years, and finally, 52.29% (i.e., 80 participants) had an age between 20-29 years. The results presented that 73.20% of the participants contributing to the questionnaire have a graduate level of education, followed by 21.57% with post-graduate degrees, 7 participants (i.e., 4.6%) had intermediate level education, and finally, 1 had other qualifications. The results from the participants' educational background help to identify that majority of the participants were well educated working in the firm's supply chain (i.e., 146 participants with graduation, post-graduation, and other qualifications). Finally, the results presented that the respondents have an experience of 3-6 years (a total of 87 participants), followed by 1-2 years' experience (28.8% of the respondents), 13 participants with 7-12 years of experience in Daraz and 9 with more than 13 years or above experience.

4.3. Hypothesis Testing

The researcher conducts a regression analysis to conduct a detailed assessment of the data to achieve the research objectives and test the hypothesis. The results from the regression analysis are provided under two separate regression models, one with the dependent variable of overall sustainability and the other to test the impact of green packaging and green purchasing on the operational performance of the business. The motive is to test the hypothesis and determine whether the relationship and significance between the variables are achieved.

4.3.1. Regression model for operational performance

The regression model is developed with responses to Green Packaging and environmental packaging as the independent variables and tests the impact of the two variables on the company's operational performance. The results presented in the table help to determine and highlight the combined result of the data analysis carried out using descriptive and regression analysis. The independent variables for the test (regression model) are Green Packaging and green purchasing, whereas the dependent variable is Operational Performance. The table shows that green purchasing has a mean value of 3.24, which shows that most respondents are neutral (3 = neutral option in the questionnaire). For Green Packaging, the mean value is 3.60, which is closer to 4 and helps to reflect that most respondents agree or remain neutral on their choice. The overall performance shows a value for the mean of 3.95 or (4 – rounded off to 0 decimal places).

The regression results help to identify a weak relationship between the variables (R Square value is .164). The significance value presented in the ANOVA table of regression is .000, which reflects that a significant weak relationship is evident between the variables (i.e., green purchasing, Green Packaging and overall performance). The results from the Coefficient values reflect that the model represents a good fit between the dependent and independent variables, and the constant shows a significant relationship. Moreover, the green purchasing is found to reflect a feeble impact on operational performance (B – Beta value is .087 (i.e., 8.7%), the significant value is .237, which reflects the increase in environmental packaging by Daraz is found to have no significant impact on operational performance. On the other hand, Green Packaging is found to have a weak impact on operational performance. The results presented in the table show that increasing the Green Packaging by the business can result in improvements to the operational performance by 29.1% (0.291), and the value of significance is .000, which shows that the impact of the independent variable (Green Packaging) is significantly positive and weak on operational performance.

Table 2: Regression model for operational performance

Variables	N	μ	StDev	Model Summary		ANOVA		Coefficient		
				R	R^2	F	Sig.	Std. Beta Coefficient	T	Sig.
Green purchasing		3.24	.878					.087	1.19	.000
Green Packaging		3.60	.827	.404	.164	14.67	.000	.291	3.726	.000
Overall Performance	153	3.95	.717							

4.3.2. Regression model

The regression analysis is carried out to test the impact of Green Packaging and environmental packaging (Independent variables) by Daraz and its impact on sustainability Do Sustainability (Dependent variable). The table shows that Green Packaging and environmental packaging are the independent variables, the Do Sustainability is the dependent variable for the regression model. The results from the model summary are beneficial for determining the relationship between the variables tested under the regression model. The R Square value is .253, which reflects that the variables tested under the regression model have a weak relationship.

The significance value for the model is .000. Therefore, it can be interpreted as the increasing support for Green Packaging and green purchasing for Daraz can lead to a weak and significant impact on sustainability (i.e., by 25.3%). The results from the coefficient table are critical as these reflect the impact of the two independent variables on sustainability. The results from the coefficients table show that environmental packaging is found to have a weak and significant impact on sustainability (Beta value .181 (i.e., 18.1% increase), and Sig. value is .011 (i.e., less than .05)). The results help to conclude that the increase in green purchasing by Daraz can lead to improving the sustainability for the company by 18.1%. Moreover, the results also help to identify the adoption and increase in Green Packaging by Daraz is likely to have a significant and moderate impact on maintaining and improving the sustainability. The value of Sig. is .000, which is less than 0.05, whereas the Beta value is .304, which reflects that the impact is positive moderate and significant. It can be concluded that the improvement in Green Packaging by Daraz is likely to improve the results for sustainability by 30.4%.

Table 3: Regression model for sustainability

Variables	N	μ	StDev	Model Summary	ANOVA	Coefficient

				R	R^2	F	Sig.	Std. Beta Coefficient	T	Sig.
Green purchasing		3.24	.878					.181	2.58	.011
Green Packaging		3.60	.827	.503	.253	25.41	.000	.304	4.08	.000
Do Sustainability	153	3.73	.724							

4.3.3. Hypothesis assessment summary

The hypothesis for the research is planned to be evaluated using quantitative assessment/ statistical analysis applied to the responses collected from the participants. The results derived from the hypothesis testing are presented in a table that highlights the findings and conclusions of the research. The hypotheses (a total of four) are presented, and respective values from the regression model are presented to derive the outcomes.

Table 4: Hypothesis assessment summary

Hypothesis	Values
$H_{1\,(a)}$: Green purchasing significantly influences sustainability.	Beta .181, Sig. .011
Based on the outcomes derived from the analysis (regression analysis), it is found that green purchasing positively impacts the dimension of sustainability; therefore, $H_{1\,(a)}$ is accepted.	
$H_{1\,(b)}$: Green purchasing significantly influences operational performance.	Beta .087, Sig. .237
The results help to identify that green purchasing has no impact on operational performance. Therefore, $H_{1\,(b)}$ is rejected, and an alternate hypothesis is accepted "*green purchasing does not impact operational outcomes*".	
$H_{2\,(a)}$: Green packaging significantly influences sustainability.	Beta .304, Sig. .000
The outcomes show that a moderate impact of green packaging on sustainability is evident, and therefore $H_{2\,(a)}$ is accepted.	
$H_{2\,(b)}$: Green packaging significantly influences operational performance.	Beta .291, Sig. .000
The findings show a positive and significant impact of Green Packaging on the operational performance of Daraz, and therefore, $H_{2\,(b)}$ is accepted.	

5. Conclusion

The motive of carrying out the research is to derive insights regarding the application of SSCM, including the environmental and Green Packaging carried out by Daraz and its impact on performance and sustainability. The researcher assesses past research to identify the relevance and discussions carried out in the past research related to the topic and has highlighted that businesses worldwide are focused on sustainability management and have received considerable attention. To achieve the research hypothesis, the researcher carries out quantitative research, which is focus of Daraz on environmental and Green Packaging and is evaluated on the sustainability by the business and its operational performance. Analyzing the responses from supply chain professionals (a total of 153 respondents) using SPSS and AMOS helped identify the application of green purchasing by Daraz is found to have a positive and significant impact on sustainability. In contrast, no significant impact on operational performance is identified. Moreover, the adoption of Green Packaging by the company has a significant positive impact on sustainable dimensions and operational performance. The findings help to identify that the development and plan of the business towards Green Packaging to facilitate the delivery items reflect that the sustainability and the operational performance of the business are improved. The operational performance is improved due to the decline in the overall waste and process improvements. Furthermore, the environmental, as well as social dimensions, are found to be improved due to the focus on sustainable progress.

5.1. Discussion

The findings from the research allow the development of an understanding of the application of Green Packaging by Daraz has led to improvements in the sustainability. The findings from the literature review also help to identify that not only is the positive impact of Green Packaging on the environmental, economic, and social dimensions noticeable, but organizational benefits are evident in past research studies (James, Fitzpatrick, Lewis, & Sonneveld, 2005). The focus of Daraz to limit the environmental impacts with Green Packaging is found to have positive outcomes for the sustainability and also for the operational performance of the business is supported by Verghese and Lewis (2007). On the other hand, the impact of the business has led to increased customer satisfaction, reflecting a

positive impact on performance, as supported by the viewpoint put forward by (Rajeev et al., 2017). The business can improve the overall supply chain efficiency in the long run, as presented and highlighted by (Beske & Seuring, 2014). The results help to identify that the application of Green Packaging by Daraz can have a long-term impact on its performance improvement. Further, the focus of the research on deriving insights about the green purchasing carried out by Daraz is considered to be an influential factor that can positively, however, weakly impact the sustainability and is found to have no impact on operational performance. The research findings from the literature help to identify that global businesses are focused on maintaining and ensuring focus on green purchasing as the main factor in improving and integrating sustainability within the business practices (Zhang et al., 2013). The focus of Daraz ensures that a sustainable relationship with the suppliers and vendors can be created, affecting customer satisfaction and further improving the brand image (Eltayeb & Zailani, 2014). The supplier's and customer's requirements can be efficiently managed by applying green purchasing. All the products are developed and supplied to the customers using sustainable raw products and Green Packaging by Daraz. The research studies also highlight that the focus of businesses to improve the overall environmental impact is found to have a long-term impact on the overall performance of the business (Bjorklund, 2010; Rezaei et al., 2016) and, therefore, Daraz is more likely to reflect improved operations and sustainability in the long term. With time, increasing awareness among customers and other stakeholders would help determine to reap the outcomes for the business.

5.2. Implications

Based on the outcomes derived from the research, the following practical implications for the business as well as other businesses are offered. The company (Daraz) must continue to develop sustainable environmental relationships with the suppliers and focus on Green Packaging to reap future positive outcomes. The managers and the management of the business are recommended to improve the awareness of the customers about the efforts towards a sustainable supply chain and to maintain effective supplier and packaging-related sustainable policies. The rise in awareness is considered necessary for the business as it can help improve it’s business's overall performance and long-term improvements in sustainability. The people once aware would find the company to offer a focus on sustainability, and it would lead to improving the overall business image and value for the business. The management of the business must focus on improving the operational factors, which include the efficiency in supply chain practices, processes, and other activities so that a long-term positive impact on operational performance can be achieved, which is not currently evident from the research outcomes. Other businesses are also recommended to focus on sustainability (Green Packaging) and green purchasing to improve their brand image and future profit abilities. The focus is compulsory as the customer and other stakeholders demand for sustainable products and services is rising worldwide.

5.3. Limitations

The prime limitation of the research includes time and budget constraints. The time constraints for the research restricted to completing the data collection and completion of the research in 2 semesters. The researcher ensured that the most reliable and authentic ways to collect and analyze data were carried out. The time limitations resulted in collecting data from 153 respondents. In contrast, the plan was to give time to the supply chain management at Daraz and at least 200 responses from managers, executives, and others from the company's supply chain department (data collected through personal contacts). The budget constraints restricted the participant to not taking part directly in the data collection as the survey questionnaire was provided to 2 people in the supply chain department at Daraz. The researcher could not go to Islamabad and Lahore by himself for data collection from the respective sample from the company's warehouses. The limitations of the research did not lead to any major impact on the reliability of the responses. However, future researchers can be asked to carry out more focused and detailed research in which their contribution is high in data collection and other roles.

5.4. Recommendations

The results from the research help to identify that Green Packaging positively impacts the

sustainability and operational performance of Daraz. Furthermore, the application of green purchasing is found to have no significant impact on the operational performance of the business. In contrast, a positive and weak impact on sustainability is evident. The focus of the section is to offer recommendations to the management of the company and other businesses to effectively contribute to sustainability from a Pakistani perspective to achieve better operational and environmental outcomes in the future. The focused research helps to identify that the green purchasing by the company is not as efficient as no impact on operational performance is identified. The outcomes help to raise a concern, and therefore, the management recommends that efficiency in terms of green purchasing must be ensured so that effective operational and financial outcomes can be derived (Zhang et al., 2013). Daraz is required to manage coordination and communication between the suppliers effectively. It is also required to focus on raising awareness of the efforts put in by the company to improve green purchasing. The focus can help raise customers' knowledge and better understand that the company is focused on maintaining effective supplier and packaging management to support sustainability (Eltayeb & Zailani, 2014). Furthermore, continuous improvements to the internal operational procedures and activities are also recommended to the management as the focus on improvements can lead to an increase in the efficiency of the sustainability contributions and further can lead to improving delivery and other aspects of the business (Carter & Jennings, 2002; Eltayeb et al., 2021).

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Lean Manufacturing and Sustainable Performance with a Moderation of Organizational Culture

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ABSTRACT

This study explores the contribution of lean practices in a manufacturing firm in Karachi towards sustainable performance while considering organizational culture as a moderator. Lean approaches benefit firms' social, environmental, and financial aspects, influencing their endurable performance. Manufacturing firms nowadays globally are focused on lean implementation. A structured questionnaire was distributed among employees of the Small and Medium Enterprises in Karachi that fit in the category and belonged to the manufacturing enterprises. A sample of 200 respondents was analyzed using the partial least squares technique (PLS-SEM). The results indicate that Human resource practices, Supplier relationships, and organizational culture significantly affect sustainable performance; furthermore, organizational culture moderated the supplier relationships' impact on sustainable performance. Thesis outcomes contribute to the analysis of the study, broadening the writings on lean manufacturing and sustainable performance with a Moderation of Organizational Culture. The finding of the thesis possibly will be used as a motivation for firms in Karachi to implement Lean approaches as companies that adopt Lean practices globally have the result of improving firms' endurable performance through lean manufacturing approaches.

Keywords: *Lean manufacturing, SME, Karachi, Performance, Sustainable, PLS-SEM*

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Lean Manufacturing and Sustainable Performance with a Moderation of Organizational Culture

1. Introduction

Manufacturing industries are producing goods on an immense scale because the demand for goods and services is increasing daily. On the other hand, competition is getting tough because of technological adoption; technological innovation requires time to compete with rivals and overcome increasing customer demand/awareness demands. So industries go for technological boom and strategies to produce and supply a large number of goods, to sustain in the market with a competitive advantage, and sustainable performances ultimately resource consumption and waste everywhere the planet goes up. As far as the stakeholders and regulative agencies are concerned, they pressure manufacturing firms to be more sustainable due to the warnings about global warming and social issues. Stakeholders instruct that companies are environmentally and socially accountable, and firms have become attentive to playing their strategic part in sustainable performance as a competitive advantage. In addition, numerous studies have proposed that embracing lean manufacturing can improve firms' environmental, social, and financial performance.

Illustrating lean can be an operational activity that improves competitive functions such as quality, flexibility, expenditure, and delivery within organizations (Bhuiyan & Baghel, 2005; Khanchanapong et al., 2014; Hallgren & Olhager, 2009; De Toni & Tonchia, 1996). "A method designed to lower the costs in production to minimize scrap" can be stated as lean manufacturing. Lean manufacturing is "a corporate strategy and methodology that enriches process performance with the outcome of enhanced customer fulfilment and improves bottom-line results" (Snee, 2010). Researchers have revealed that lean manufacturing invariably enriches the operational performance of firms. Therefore, from other techniques, lean manufacturing is adopted. Lean manufacturing is recognized with declines in customer lead time, cycle time, and costs while improving the quality of operations and products along with these factors (Khanchanapong et al., 2014; Hajmohammad et al., 2013). Research scholars have tried to search out the most practical lean manufacturing approaches. Lean practices are categorized into leading areas, 1) manufacturing planning and control, 2) process and equipment, 3) human resources, 4) product design, 5) customer relationships, and 6) supplier relationships. These areas fit well in various industries, as shown in previous studies.

Implementing Lean principles remains a mechanism that creates aggressive factors as organizations take strategic actions to stay beneficial when the economy worsens. However, like other headway programs, Lean executions have not been achieved universally in their applications because of various variables that will influence the implementation of such initiatives (Abu et al., 2021). The low achieving sufficient or enduring Lean adoption remains a management concern of institutions being incompetent to capitalize on the advantages of Lean (Barclay et al., 2022). Lean manufacturing is an approach to creating a "world-class production system. “By creating world-class systems for enhanced adequate operational capacity by lean manufacturing, organizations are better able to compete globally (Alkhoraif et al., 2019). In this study, we tend to explore how manufacturing companies will gain sustainable performance in primary areas. Particularly manufacturing planning and control, process and equipment, human resources practices, product design, customer relationships, supplier relationships, and the way organizational culture will enhance the sustainable performance of companies (Kafuku, 2019).

Prasad et al. (2020) identified lean manufacturing methods as a way to create lasting value for any business, thus implying that lean manufacturing methods are a way for manufacturers to sustain their organizations. Corporate culture is considered the primary motive for the failure of executing programs/systems to modify the organizational structure. Studies have proposed that like the instruments, procedures, and change techniques may be present, failure appears if the institution's culture remains identical (Dorval et al., 2019). Therefore, organizational values usually focus on

assessing and measuring organizational culture. However, an essential fact of cultural studies is the role of an organization towards its primary matters and principles of management in diverting or developing the execution of organizational decisions and creations belongs to reengineering, total quality management, adaptable manufacturing technologies, enterprise resource planning (ERP) systems (Taherimashhadi & Ribas, 2018; Rashid & Rasheed, 2022). So, in this study, organizational culture is evaluated as a moderator to analyze the impact of organizational culture on lean manufacturing execution, ultimately, a company's sustainable performance.

Lean manufacturing has been investigated by several studies, the relationships between across-the-board lean manufacturing towards environmental and financial performance. However, these studies suffer from limits. First, to explore how lean approaches can affect the endurable performance of businesses in terms of social, economic, and environmental characteristics to compete in the existing competitive and international market. By adopting lean approaches to balance their social, economic, and environmental performance, manufacturing companies need to understand the lean approaches that thoroughly impact all three sustainability factors and not just cover one part. In the second exploration, most earlier studies have experimented with the impact of general lean approaches on organization performance. Although lean implementation approaches vary in different areas of a business, research of these lean practices and firms' sustainable performance provide the connection between them and a clear sight of the approaches that best influence firms' sustainable performance. Finally, the organization's culture is another factor that can affect the outcomes of lean implementation or can resist lean practice implementation. So, this hypothesis study investigates the effect of lean manufacturing approaches on sustainable performance and how organizational culture can assist or resist adapting lean practices.

1.1. Research Questions

The following research questions were formulated:

RQ1: Do processes and equipment affect sustainable performance?

RQ2: Does manufacturing planning affect sustainable performance?

RQ3: Do human resource practices affect sustainable performance?

RQ4: Do supplier relationships affect sustainable performance?

RQ5: Does customer relationship affect sustainable performance?

RQ6: Does product design affect sustainable performance?

RQ7: Does organizational culture moderates the relationship between manufacturing planning and control, process and equipment, human resources practices, customer relationship, product design, and supplier relationship on sustainable performance?

2. Literature Review

2.1. Empirical Reviews

The first section of this chapter explores literature. It suggests why it is essential to separate lean implementation as a development from the organizational initiatives traditionally associated with it as a transformation process. To provide a forum for competitive edge demonstrating the lean production model's long-term impact. The paper develops a visionary approach (established on the operating view of the firm) illustrating the operational activities that strengthen sustainable competitive advantage. Ohno (1988) reported his book on the Toyota Production System (TPS). A Toyota discovered the concept of lean approaches in the 1950s Japanese automotive company, which was

documented as Toyota Production System (TPS) (Nordin et al., 2010). It might be like the 'lean' guides caused by the broader society beyond Japan after the Second World War. It is a reaction to the mass-production approach rehearsed in most American and European organizations (Herzog & Tonchia, 2014). The objective of TPS was to lessen the process, manufacturing, and operational cost and to boost productivity by eliminating wastes or non-added value else exercises. In the 1980s, the lean approaches implementations and manufacturing performance among western firms due to increasing Japanese imports showed penetration interest (Nordin et al., 2010; Alam, 2022; Asif, 2022). Ohno (1988) cited that the solution proposed by Toyota to change reconstruction of the corporate and shortly delivered thanks to the introduction of an alternative production approach revealed that is Toyota Production System (TPS) that geared toward straight offensive any waste within the production process. Besides, the Just in time (JIT) perspective was refined within the framework of this latest production system and formed explicitly out of Japanese trade's requirement to survive the post-war international demand.

2.1.1. Lean manufacturing and sustainable performance

Lean practice implementation has been associated with an intensively researched topic. Many authors agree that a standard definition of the lean manufacturing concept is lacking. For example, shah and ward (2007) suggest as an abstract definition that "lean production is an associate integrated socio-technical method whose central objective is to stop waste by at the same time decreasing or minimizing customer, supplier, and inner variability." however, as authors check with it as a system, others distinguish it as a principle: "leanness could be a perspective supposed to considerably lower down expenditure and cycle time throughout the worth supply chain of firms, whereas continued to enable product performance" (Comm & Mathaisel, 2000; Uddin, 2022; Ayaz, 2022). Considered as a strategy: "lean consideration could be a business procedure that seeks at providing a replacement manner of unique activities over the way to organize human activities to produce additional advantages to society and value to people whereas eliminating waste" (Ndaita et al., 2015).

Lean approaches cannot be inapplicable to the reflection of waste. The under part of the Lean approach is eliminating waste, which is any action that may not produce any value to the ultimate product (Pavnaskar et al., 2003). The customer does not volunteer to purchase it, so the firm's drive should be to stop it (Karlsson & Ahlström, 1996). However, it is not as straightforward, and most organizations struggle to recognize the waste (Ghosh, 2012). In Italy, Panizzolo (1998) questioned the number of businesses operating in global markets on lean approaches developed by the author to explore the extent. As a result, the lean production measure was embraced, and findings were that the mostly adopted programmers' existed on the internal procedures. At the same time, the external relationships (supplier and customer) were revealed to be more challenging. Staudacher and Tantardini (2008) also questioned each Lean and non-Lean implementer in Italy on the strategic goals and developments over time. They found that those with lean practices implementation for an extended period stated much vaster improvements.

Lean Manufacturing Practices are usually supported by the empirical evidence that it enhances the company's sustainable performance (Sanchez & Perez, 2001). Regardless, like several improvement agendas, Lean practices executions have not succeeded globally in their application and measure completely diverse variables that will influence a Lean implementation (Worley & Doolen, 2006). Furthermore, Achanga et al. (2006) acknowledge that integrated with an absence of standardized instruments at intervals, organizations of study, and live of value-adding abilities like Lean, the execution of Lean practices harbours tremendous difficulties. Some past studies have exposed that Lean implementation is at its immaturity in some countries or sectors. For example, Eswaramoorthi et al. (2011) surveyed Lean practices in Indian machine makers and concluded they were still on the newbie level of Lean commission. Similarly stated, Nordin et al. (2010), that automotive industries, measured Lean approaches implementation by adapting the dimensions from (Shah & Ward, 2003) and completed that practically all of the respondent's companies stood in the transformation toward Lean manufacturing exercise Italy (Panizzolo, 1998; Ayaz, 2022; Anwar, 2022).

2.1.2. Manufacturing planning and control and sustainable performance

Manufacturing enterprises account for a large quantity of resource consumption and scrap generation everywhere (Abdullah et al., 2016). Stakeholders and regulatory agencies pressure manufacturing corporations to be more sustainable because of the warnings concerning global warming and social issues (Zailani et al., 2015). Firms that follow sustainability as an execution goal for manufacturing operations need immediate changes to the manufacturing planning and control system (MPC). Lean practices have been preferred to boost performance because such systems contain all critical activities used for planning and controlling manufacturing within a company's functions (Silver et al., 1998). Studies include waste made within the materials requirement planning (MRP) process by adding a "Bill-Of-Waste." the objective is not to reduce waste but to spot the waste created. At the functional (short-term) level, the standing of the manufacturing operation system changes the whole time. Therefore, the skillfulness and precision of the MPC system in adjusting to the changing production circumstances are critical (Melnyk et al., 2001). However, the truth for most manufacturers is that it is challenging to predict work-in-process (WIP) inventory and resource standing accurately. Therefore, the system is frequently disrupted by quick jobs, and production breakdowns occur as unplanned activities, changeover, and set-up times (Strandhagen et al., 2017; Amjad, 2022).

2.1.3. Process and equipment and sustainable performance

Sustainability has been the foremost priority of intense discussions because of the essential role of production workouts in value addition to national economies and their environmental consequences (Camioto et al., 2014; Hunaid et al., 2021). Evaluating every aspect of sustainability as a particular variable presents a practical problem once assessing the international sustainability of a company in different directions, just in case variables mature in several directions. For example, suppose that in a business, there is an excessive loss of work generated by a severe problem in a piece of equipment/ accidents suffered by machine operators leading to loss of operating hours. The industrial engineering department proposes that increasing the cycle time by decreasing the machine speed would eliminate operator casualties nearly to the lowest level. In sustainability, this solution first enhances the social attribute of the firm because the number of casualties is significantly lowered. Secondly, it declines the economic side because the production expenditure increases (cycle time turns high). So as this matter is concerned, the company's overall sustainability improves, worsens, or remains unchanged. This query cannot be responded to without a single action that blends the three aspects of sustainability. In 1999, several leading businesses decided to be more sustainable businesses. They adopted numerous initiatives and shifts to enhance the social and environmental performance of their facilities, processes, and products in Europe, the United States, and Japan (Fiksel et al., 1999; Rasheed, 2022).

2.1.4. Human resource practices and sustainable performance

Human resource management (HRM) refers to the practices used to govern individuals and teams performing the job for the organization. These approaches are used to build connections between external stakeholders and organizations. HRM is to improve organizational performance and sustainability. The input of HRM to the competitive edge has been a prevailing theme in the literature (Pfeffer, 1995; Boxall & Purcell, 2003). These indicate human resources' capacity to influence aspects of managerial consequences, particularly individual and organizational abilities, which construct value addition to organizational performance. HRM exercises have been shown to elevate organizational performance by developing individual capabilities such as knowledge, skills, and abilities (Daniels, 2003) as well as manners and mindsets (Schuler & Jackson, 1997). HR practices in studies contribute to the development of odd cultures and organizational capabilities, such as the way innovation and learning management take place inside organizations. Certain Human resources practices such as good selection, training and development, and performance evaluation can enhance employee productivity and performance, so people declare the required capabilities to further organizational goals. HRM approaches can also create a favourable psychological arrangement between the employee and the employer. Ultimately, this can enhance loyalty, trust, organizational engagement, and a sense of righteousness (Coyle-Shapiro, 2002; Baloch & Rashid, 2022; Shaheen, 2022).

2.1.5. Product design and sustainable performance

Bruce and Bessant (2002) state that designs are, in the broader sense, the vision and planning

of artificial notions and transforming things. Product design is the exercise that converts a set of product requirements into a specification of a material's geometry and properties (Ulrich &Pearson, 1998). These researchers illustrate that product design is part of the more expansive product development exercise. These are the overall process of concept generation, product, strategy, organization, and marketing project design, implementation, and evaluation of a new product to illustrate the role of design in the product expansion process (Belliveau et al., 2004). Furthermore, provide substantial proof that good design can be related to organizational performance (Hertenstein et al., 2005). Efficient and effective designs may lean market share or create new market segments. Investment in product design has usually tied to a firm's dominant performance (Gemser & Leenders, 2001; Bloch, 1995; Ulrich & Pearson, 1998). Studies suggested that the relationship is not absolute but counts on industry development and design approaches to a particular scope. A company that sponsors design and materializes the proper skills to acquire efficient designs may have sounder results than others that do not retain such skills. The study claims that intervening factors partially mediate the relationship between design investment and firm performance from the resource-based perspective (Gemser & Leenders, 2001; Victory et al., 2022).

2.1.6. Customer relationship and sustainable performance

Marketing relationship aims to build longer, mutually good relations with key parties across the supply chain. Embracing customer association promotion enables companies to create close economic and social relations with key customers and focus on realistic, profitable customers. This marketing vision represents a replacement direction for the modern business perspective. That is to seek further competitive edge under stress changes in business surroundings, including sustainability prerequisites. This idea depends on the distinction that the principal driver of business profitability is the essence of the company's customer (Kotler & Keller, 2003), and considerably of the company's market worth and competitive edge comes from intangible investments across the supply chain. Whereas traditionally, firms retain the most well-liked to seduce frequently more fresh customers, this vision drives the policy of customer retention and constructing customer devotion. Firms have acknowledged that the expenditure on customer retention is lower than that on reaching newer customers. Devoted customers are inclined to buy more additional products from the selected company. They admire each and are worth social delivery and transferring benefits between the company and customers. Devoted customers are frequently ready to spend even at exceptional prices. The sustainability consideration of customer association dealing includes the chance to make a faithful customer base operating more increased satisfaction, including products and services in favour of environment-friendly, and consequently the social worth and reputation of having intended consumer behaviour (Antonides & Raaij, 1996). Organizations may target devoted customers and entertain them as fellows for more activities related to sustainability conditions.

2.1.7. Supplier relationship and sustainable performance

Supplier relationship management (SRM) has become an essential business method due to the inflated off-shoring and outsourcing of administrative processes and production. It can considerably impact achieving sustainability goals (Ashby et al., 2012; Ali, 2022). SRM can be viewed as a practice of influencing supplier behaviour and impacting the sustainability practices of the organization by working with suppliers in activities like improving operational functions in warehouses, reducing packaging, using more cost-effective transport, and taking on environmental and social programs requiring all these from suppliers' end (Carter & Rogers, 2008). In current years, it has evolved more noticeably that organization should develop their sustainability measures far away from intra-organizational executions. These organizations must commit their actions across the supply chain (Sajjad, 2015). In some cases, suppliers are found to be operating businesses unethically. Focal organizations are sometimes held liable for their supplier's actions. These focal organizations then face pressure from stakeholders to examine the sustainability problems within their supply chain networks (Boström et al., 2015). Ağan et al. (2016) explored that around 60% of parts or services are acquired from suppliers. In a comprehensive view, sustainable supplier connections have been recognized as a core of institution competitiveness (Nagati & Rebolledo, 2013; Esfahbodi et al., 2016). Therefore, it's impossible for an organization nowadays to be sustainable without considering suppliers for sustainable performance (Esfahbodi et al., 2016; Muzammil, 2022).

2.1.8 Organizational culture and sustainable performance

According to Schein (1985), organizational culture is abstracted as "the approach of primary thoughts and beliefs that a group has developed, learned, or designed while it retains to deal with its internal integration and outward transformation concerns. That has behaved so well to be gauged correct, and from their perspective, it repositioned to new members as the correct way of sensing, judging and handling regarding those concerns" (Schein, 1985). Similarly, an organization's culture could be individuals' or teams' collective methods, standards, beliefs, principles, and patterns (Zakari et al., 2013). For example, a work procedure based on practice represents corporate culture as "the mindsets or set of conducts observed in perceptions of approaches shared by team players in certain ways that administer motivation or settle the concerns discovered in the track of a team task" (Nguyen & Watanabe, 2017). As discussed earlier, studies hold determined organizational culture's importance in sustainable organizational execution. Developing research studies in organizational culture have concentrated on the functions of cultural attributes. The outcomes indicate that every cultural trait positively affects overall firm performance, sales growth, and asset return (Yilmaz & Ergun, 2008; Basit, 2022).

2.2 Underpinning and Supporting Theories/Models

This section will explore the multiple theories/models to demonstrate an understanding of theories/models and concepts appropriate to this study.

2.2.1. Integrating lean management with DMAIC/DMADV

DMAIC is examined as Define, Measure, Analyze, Improve, and control. DMADV is examined as Define, Measure, Analyze, Design, and Verify/Validate. These are two distinct techniques for the refinement of the procedure. Lean practice intends to recognize and stop waste in the complete process. DMAIC/DMADV is utilized to spot and terminate variation in a process. The DMAIC process in a Lean Management system can be clarified and described. The first step is to define the problem for the selected Project and define the problem. The second step is to measure data about process performance as a process map for recording activities. The third step is to analyze the problem's suspected root cause(s) and verify. The fourth step is to improve the process by taking measures to reduce flaws and divergence caused by source cause(s) and execute selected measures. Finally, the last step is to control the procedure to confirm sustained enhanced performance.

The DMADV Process can be clarified and explained as follows: The foremost step is to define the concern for the selected Project and define the problem; the second step is to measure crucial quality attributes related to the process and product; the third step is to analyze to form design, it is alternatives, and evaluate to determine the most suitable design; fourth step is to design test and optimize the design and prepare for design validation; and the last step is to validate the design outcome fulfils and design input that is requirements, implement the process, and ultimately hand it over to the process owners. DMAIC is a process refinement instrument used to revise an existing process that does not deliver the expected performance. DMADV outlines an organized strategy for defining, designing, and implementing a new process where no process presently lives. Although both have identical attributes, virtually all Lean concepts integrated well with these tools, having two distinct visions of identifying and stopping waste versus identifying and stopping variation.

2.2.2 Theory of constraints integrating lean management

The theory of Constraints carries the general objective of achieving profit maximization, which is accomplished by increasing the production rate of processes and operations in a system. Attaining maximization of Profit by increasing Throughput (rate of production or speed of process) can be obtained by being more efficient in the company's resource management (Saleh et al., 2019). Therefore, it is required to focus on the constraint because its elimination offers a greater return to resource management and operation; the constraint can be defined as the weakest connection in the Process (Slack et al., 2016).

Goldratt (1990) shaped five steps to reduce or remove the constraint: The foremost step is to

determine the constraint: specify a physical process step, origin, and corporate policy that restricts the operation's production pace. The second step leads to controlling the constraint to determine how to do all potential ways to use the constraint to its utmost capacity. Involve Six Sigma, Lean, or other methodology upgrading methods where suitable. The third step leads to the above decision: the constraint should be adjusted to support and deferred to all other activities to ensure it operates at peak effectiveness. The last step is to promote the constraint. Suppose the performance of a system is still not at a satisfactory level; time to consider investments in the constraint to improve or eliminate. For example, it refers to expenses for technology adoption, or personal development may be required to eliminate/reduce the constraint. The last step is to repeat the cycle; this theory is about continuous improvement. When the recent constraint is shattered or dismissed, return to the following constraint in the system/process. Such improvements prepare the organization to grow to be a Lean management institute. Even if Lean and TOC (theory of constraint) illustrate two procedures to process modification, they are highly interconnected. Therefore, managing constraints establishes an atmosphere where the participants can understand their procedure deeply. Figure 1 illustrates the research framework of this study.

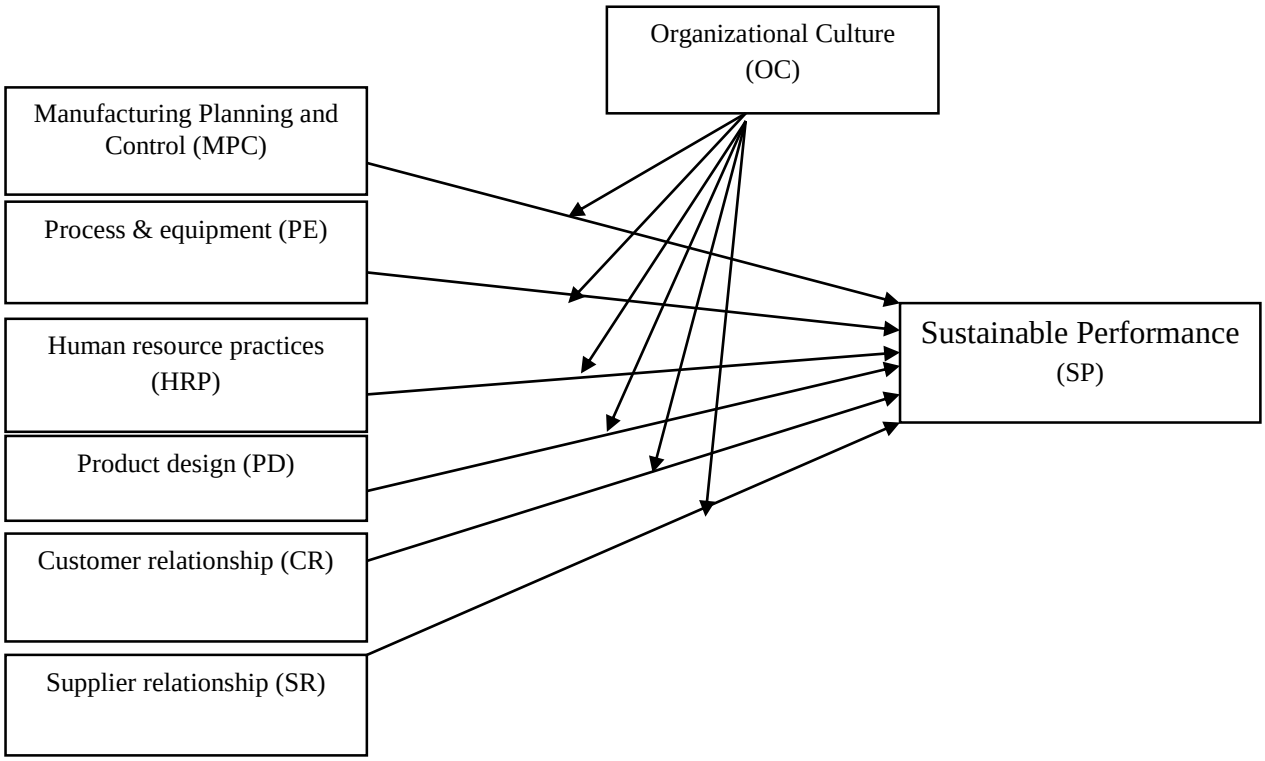

Figure 1: Research framework

2.3. Hypotheses

The following hypotheses are developed from the framework of this research to test the effect of lean manufacturing practices on sustainable performance,

H1: There is a significant effect of manufacturing planning and control on sustainable performance

H2: There is a significant effect of process and equipment on sustainable performance

H3: There is a significant effect of human resource practices on sustainable performance

H4: There is a significant effect of product design on sustainable performance

H5: There is a significant effect of customer relationships on sustainable performance

H6: There is a significant effect of supplier relationships on sustainable performance

H7: There is a significant effect of organizational culture on sustainable performance that moderates

H7a: There is a significant moderating effect of organizational culture on process & equipment and sustainable performance,

H7b: There is a significant moderating effect of organizational culture planning on control and sustainable performance,

H7c: There is a significant moderating effect of organizational culture on human resources practices and sustainable performance,

H7d: There is a significant moderating effect of organizational culture on product design and sustainable performance,

H7e: There is a significant moderating effect of organizational culture on supplier relationships and sustainable performance, and

H7f: There is a significant moderating effect of organizational culture on customer relationships and sustainable performance

3. Research Methodology

The explanatory research approach is used in this research as it is closely connected to hypothesis testing using deductive reasoning (Alrazehi et al., 2021; Das et al., 2021). "The deductive approach is used to develop hypotheses to test variables based on existent theory and leads to research design to test the hypothesis based on theories" (Wilson, 2014; Hashmi & Mohd, 2020; Hashmi et al., 2020a, b). Deductive reasoning is described using hypotheses derived from the theories. In other words, deductive reasoning is discussed by findings from statements or debates to provide proof. The deduction procedure initiates with a typical pattern "tested in opposition to statements, the procedure for induction initiates with statements and seeks to discover a pattern" (Babbie, 2010). The deductive technique proposes some advantages, the "potential to demonstrate connections and directions among concepts and variables, the potential to estimate concepts quantitatively, and the potential to take an overall view of research conclusions to a particular level. So, this study's deductive research approach leads to quantitative research.

3.1. Research Design

This study used the quantitative approach to conclude from empirical evidence. Its reasoning can be defined in the positivist pattern to test statements (Hashmi et al., 2021a; b; Rashid et al., 2020; Rashid et al., 2021). The quantitative research approach relies on drawing empirical evidence from a large population by data collection. Further, the quantitative approach measures the objectives via actions and opinions to streamline representing the data rather than interpreting it. Rashid et al. (2021) argued that "explanatory study assists in determining the reasonableness of the happening of a distinct phenomenon." This study usually describes a casual problem and is appropriate to the quantitative approach. This approach authorizes a fresh understanding to develop, build, or test a hypothesis. The quantitative approach used in illustrative research aims to identify issues and key variables in a specific situation.

3.2. Sampling Design

Sampling design is the roadmap for the researcher; the next step of defining the target population is how to select a sample size that can represent the population, what sampling techniques are more suitable for the targeted population and the collection of data from the sample size. A population represents all entities or persons a researcher expects to understand. In most cases, assessing the entire population is not feasible or possible; sampling is used to select a proportion from the population for study to measure the characteristics of that population based on sampling (Rashid et al., 2021). The targeted population for this study is small and medium enterprises (SMEs), and samples from the population are used to draw and represent a conclusion. The general question has been there to draw a sample size from the population in academic writings. However, deciding the suitable sample size is always challenging for investigators as the statistical methods and processes are broadly sensitive and need to be carefully selected the sample size (Rashid et al., 2021). Inferior is the sample size of 50, poor is 100, reasonable is 200, good is 300, excellent is 500, and more than excellent is 1000, which is a rule of thumb recommended for determining an adequate sample size (Rashid et al., 2021). Further, explained that a sample size of a minimum of 200 samples is needed for small and medium enterprises study. Furthermore, to decide the proportions of utilized items in factor analysis, a minimum of five times or a maximum of ten times indicators form a sample size (Rashid et al., 2021).

The targeted population for this research is SMEs, "Lean manufacturing and sustainable performance with a Moderation of Organizational Culture," a sampling approach is used as the likelihood of each unit selected is not confirmed or unidentified. The sampling approach of non-probability selection is divided into convenience, quota, judgment, and snowball (Rashid et al., 2021). The sampling approach from non-probability was selected as convenience sampling for this study, where the data gathering is voluntarily available at the researcher's comfort. This method assists researchers in getting responses cost-effectively but is usually condemned for finite selection due to the lack of equality in the target population (Rashid et al., 2021).

3.3. Instrument of Data Collection

Quantitative studies are based on primary and secondary data. This study needs primary data, the type of data collection one has explicitly collected for one's projects. In contrast, secondary data are the type of data collection that pre-exits data collected for research projects or commercial purposes (Rashid et al., 2019). The main distinction between these two primary and secondary data is that 'new' data while the other is 'used' data in previous studies or available on demand (Maylor & Blackmon, 2005). Data was acquired using structured questionnaires or observation to collect primary data from individuals, used in quantitative research methods, collected data transformed into numerical data. Enterprise researchers often direct to quantitative data collection as survey research. The data range from opinions, statements, mindsets, behavior, and lifestyles on individuals with general background information on their demographic attributes (Hair et al., 2007). Hair et al. (2007) explained a set of questions to measure as a questionnaire used by respondents to record answers (primary data). Primary data was collected by designing questionnaires with a prearranged frame consisting of questions and scales. However, Lee and Lings (2008), "the research will also be less than satisfactory without a sound tool, this will mean that study data will never be of high quality, and of course. Further, urged that the span of the questionnaire is likely the fundamental factor in impacting people's response to your questionnaire."

3.4. Procedure of Data Collection

The targeted population of SME firms in Pakistan to implement lean practices from this study's sampling frame. The data were gathered from the executives who directly participate in the manufacturing process, as they have direct participation in the process related to manufacturing. Therefore, they have facts and knowledge of their enterprises' lean implementation. On behalf of that, they can answer the essence of this study. The participants were selected from different corporate departments, as this study is a multidimensional approach that progressively moves from operations to

other business functions. Structured questions were distributed to collect the primary data using convince sampling, as discussed in the above section (Rashid & Amirah, 2017).

3.5. Statistical Technique

Descriptive statistics used in this research to present the collected data in a summarized manner refers to dealing with collecting, arranging, summarizing, and expressing quantitative data is the type of statistics. Central tendency mode, mean, and median are the measures of descriptive statistics. The inferences for research on the population are based on the observations made on the data collected through sampling. Statistics deals with the procedures and techniques by which inferential statistics offer a pathway for testing the significance of results acquired by collected data. It thus uses likelihood, the chance of an event occurring. Analysis of Variance, Covariance, Correlation Analysis, and Multiple regressions used to generate inferences based on collected data (Rashid, 2016). For the study, unprocessed raw data must be processed using computers. Because manual procedures for evaluating and calculating appropriate statistics have become increasingly tiresome or unthinkable in this technological world, the software for this research, SPSS and Smart PLS, contains multiple considerable common statistical approaches.

4. Results and Findings

The data collected is based on this research study methodology. Data obtained from respondents were analyzed through statistical tools and procedures to test whether the sampling results matched the previous theories and literature. The sampling data of 200 respondents is explained in a descriptive profile using SPPS software. The model must be validated before hypothesis testing to check the data's reliability and validity. R-Square represents model representation by variables present corresponding to this study; later in the chapter, hypotheses testing was carried out using SmartPLS-4 (PLS-SME); later, a summary of hypotheses shows which hypotheses are accepted or not.

4.1 Demographic Profiles

In the first section of results and findings, descriptive profiles of respondents are described in table 1 for the sample size of 200 respondents; this provides the frequency and percentage of respondents. Gender is divided into two groups, male and female, Demographic items of male respondents are 159 (79.5%), and female respondents are 41 (20.5%). Age is divided into four groups. Demographic items of age groups are 20 to 30, 31 to 40, 41 to 50, and 51 to 60 Years are 60 (30%), 95 (47.5%), 31 (15.5%), and 14 (7%), respectively. The level of education is classified into four groups. Demographic items of the level of education are Matric, Intermediate, Graduate, Postgraduate 2 (2%), 59 (24.5%), 110 (55%), and 39 (19.5%), respectively. Finally, experience is divided into four groups, Demographic items of experience are 0 to 5, 6 to 10, 11 to 15 years, and 16 Years and above are 46(23%), 73(36.5%), 45(22.5%) and 36(18%) respectively.

Table 1: Respondent's demographic profile

Demographic Items	Frequency	Percentile %
	Gender	
Male	159	79.5
Female	41	20.5
Total	200	100
	Age	
20-30 Years	60	30.0
31-40 Years	95	47.5
41-50 Years	31	15.5
51-60 Years	14	7.0
Total	200	100
	Education	
Matric	2	1.0
Intermediate	49	24.5

Graduate	110	55.0
Postgraduate	39	19.5
Total	200	100
Experience		
0-5 Years	46	23.0
6-10 Years	73	36.5
11-15 years	45	22.5
16 Years and above	36	18.0
Total	200	100

4.2 Validation of Model

In the second section of results and findings, the data were analyzed on SmartPLS-4 for confirmatory factor analysis. SEM software for a partial least square (PLS) is Smart PLS, which enables the path modeling methodology with a two-step data analysis approach (Sarstedt & Cheah, 2019). Reliability and validity are the measures used to confirm factors analysis for items loading on latent variable and construct. If sufficient reliability and validity exist, then the quality of research works exists with the outcome of accurate results.

4.2.1. Construct reliability and convergent validity

Acceptable reliability for construct specifies if Cronbach's Alpha (α) and composite reliability (CR) are more significant than 0.7 for established scales to construct reliability (Ghozali, 2014). Convergent validity exists when the average variance extracted (AVE) cutoff point is more significant than 0.5 of items by their respective constructs (He & Li, 2011; Khan et al., 2022a, b). Table 2 represents that the threshold for Cronbach's Alpha (α) and composite reliability (CR) is more than 0.70 for all latent variables exceeding the cutoff point, so there is sufficient construct reliably; this indicates that all items represent variables very well. The AVE of all latent variables is higher than 0.5, which indicates sufficient construct validity; all latent variables have a good base over the individual item. All the values are more significant than the cut point weights, fulfilling the assumptions for the test.

Table 2: Construct reliability and convergent validity

Latent variables	NO. of items	Cronbach's Alpha α	CR	AVE
Manufacturing Planning and Control (MPC)	05	0.869	0.905	0.657
Process & Equipment (PE)	05	0.897	0.924	0.710
Human Resource Practices (HRP)	05	0.890	0.919	0.696
Product Design (PD)	04	0.891	0.923	0.752
Customer Relationship (CR)	04	0.847	0.890	0.672
Supplier Relationship (SR)	05	0.864	0.900	0.644
Organizational Culture (OC)	05	0.905	0.930	0.728
Sustainable Performance (SP)	05	0.870	0.906	0.659

4.2.2. Discriminant validity

The squared value of AVE (average variance extracted) of any latent variable (the diagonal value shown in table 3) exceeds the associated values under diagonal values, indicating Discriminant validity (Ghozali, 2014). By using SmartPLS-4 results in table 3 Fornell-Larcker Criterion, the Squared value of AVE (Average Variance Extracted) values exceed their respective column values indicating Discriminant validity exists. For appropriate Discriminant validity, Fornell and Larcker (1981) specified that "for each latent variable's squared value of AVE to be greater than its correlation with each construct." Therefore, all the diagonal values are more significant than the cut point for respective column values, fulfilling the test assumptions (Agha et al., 2021; Haque et al., 2021; Khan et al., 2021; Khan et al., 2022c).

Table 3: Discriminant validity

	CR	HRP	MPC	OC	PD	PE	SP	SR
CR	0.820							
HRP	0.324	0.834						

MPC	0.342	0.636	0.811					
OC	0.338	0.560	0.622	0.853				
PD	0.247	0.397	0.417	0.464	0.867			
PE	0.314	0.592	0.652	0.548	0.410	0.843		
SP	0.353	0.656	0.629	0.736	0.400	0.588	0.812	
SR	0.160	0.218	0.181	0.292	0.245	0.158	0.288	0.802

4.2.3 Adjusted R square

R squared and Adjusted R squared values are shown in Table 4. If the values of R-Squares are 0.75, then the model is substantial, 0.50, then the model is moderate, and 0.25, then the model is weak (Hair et al., 2017). As the model has multiple independent variables, adjusted R-square indicates that independent variables represent 66% of the model and 34% represented by other variables not taken in this model.

Table 4: R square and adjusted R square

	R-square	R-square adjusted
SP	0.682	0.660

4.3. Hypotheses Testing

The developed hypotheses for this study were tested in SEM on t values, beta values, p-values, and the hypotheses direction (Hair et al., 2019). PLS bootstrapping can provide more precise estimates of moderator effects by reporting an error that attenuates corresponded relationships and improves the confirmation of theories (Chin et al., 2003). In table 5, hypotheses results showed, and only three Independent variables that significantly impact dependent variables are supported. 1) Significant impact of human resource practices (HRP) on Sustainable Performance (SP) with a path coefficient of 0.274 and p-value of 0.000. 2) Significant effect of Supplier relationship (SR) on Sustainable Performance (SP) with path coefficient of 0.084 and p-value of 0.037. 3) Significant effect of Organizational culture (OC) on Sustainable Performance (SP) with a path coefficient of 0.407 and p-value of 0.000. All other hypotheses not supported that there is no significant effect of Manufacturing Planning and Control (MPC), process and equipment (PE), Customer relationship (CR), and Product design (PD) on Sustainable Performance (SP).

Table 5: Hypotheses testing

Hypothesis	Relationships	Path Coefficients (β)	*p*-value	Decisions
H1	MPC -> SP	0.108	0.080	Not Supported
H2	PE -> SP	0.140	0.060	Not Supported
H3	HRP -> SP	0.274	0.000***	Supported
H4	PD -> SP	-0.047	0.172	Not Supported
H5	CR -> SP	0.018	0.344	Not Supported
H6	SR -> SP	0.084	0.037*	Supported
H7	OC -> SP	0.407	0.000***	Supported
H7a	OC x PE --> SP	0.083	0.138	Not Supported
H7b	OC x MPC--> SP	0.038	0.334	Not Supported
H7c	OC x HRP --> SP	-0.014	0.432	Not Supported
H7d	OC x SR --> SP	-0.148	0.005**	Supported
H7e	OC x CR --> SP	0.015	0.400	Not Supported
H7f	OC x PD --> SP	-0.052	0.216	Not Supported

** p < 0.05, ** p < 0.01, ***p < 0.001*

Table 6 shows the moderation impact of organizational culture on manufacturing planning and control (MPC), process and equipment (PE), human resources practices (HRP), product design (PD), supplier relationship(SR), and customer relationship (CR) to Sustainable Performance (SP). Organizational culture's moderation development significantly impacts supplier relationship (SR) on Sustainable Performance (SP) with a path coefficient of -0.148 and p-value of 0.005. All other Moderation effects are not supported. There is no significant effect of Organizational culture (OC) that moderates Manufacturing planning and control (MPC), process and equipment (PE), human resources practices (HRP), customer relationship (CR), and product design (PD) on Sustainable Performance (SP).

4.4. Hypotheses Assessment Summary

Table 4.6 shows the summary of hypotheses statement and decision, either supported or not supported.

Table 6: Hypotheses summary

Hypothesis	Relationships Statement	Decisions
H1	There is a significant effect of manufacturing planning and control on sustainable performance	Not Supported
H2	There is a significant effect of process and equipment on sustainable performance	Not Supported
H3	There is a significant effect of human resource practices on Sustainable Performance	Supported
H4	There is a significant effect of product design on sustainable performance	Not Supported
H5	There is a significant effect of customer relationship on sustainable performance	Not Supported
H6	There is a significant effect of supplier relationship on sustainable performance	Supported
H7	There is a significant effect of organizational culture on sustainable performance	Supported
H7a	There is a significant moderating effect of organizational culture on process and equipment and sustainable performance	Not Supported
H7b	There is a significant moderating effect of organizational culture on planning and control and sustainable performance	Not Supported
H7c	There is a significant moderating effect of organizational culture on human resources practices and sustainable performance	Not Supported
H7d	There is a significant moderating effect of organizational culture on supplier relationship and sustainable performance	Supported
H7e	There is a significant moderating effect of organizational culture on customer relationship and sustainable performance	Not Supported
H7f	There is a significant moderating effect of organizational culture on product design and sustainable performance	Not Supported

5.1. Conclusion

Lean approaches in manufacturing firms have been drawing interest across the world. Many companies have used them as a positive feature to improve performance and gain a competitive advantage. This study aimed to discover the moderation development of the relationship between lean manufacturing approaches for manufacturing firms in Karachi, Pakistan, on sustainable performance. This research study suggests that firms with human resource practices, managing supplier relationships, and organizational culture positively and significantly influence sustainable performance. In addition, the moderation development of organizational culture established by supplier relationships influences sustainable performance.

5.2. Discussion

The study was conducted under the quantitative research method to explore the significant effect of lean practices with the moderation of organization culture on the sustainable performance of firms. This study used connivance sampling with 200 respondents and constrained time and expertise. A study explored how manufacturing companies will gain sustainable performance in six primary areas. Particularly manufacturing planning and control, process and equipment, human resources, product design, supplier relationships, customer relationships, and how organizational culture will enhance the sustainable performance of companies. A non-significant result of the study may be based on previous findings; the lacking of achieving an adequate or enduring Lean adoption remains a management problem of organizations being incapable of capitalizing on the benefits of Lean (Karim & Arif-Uz-Zaman, 2013).

The research purpose is to find whether the hypothesis is supported or not. Even if data differs from expected, recording accurate results and concluding based on collected information still holds informative results. These non-significant results can be affected by a change in methods, low statistical power, different population, etc. Results differ along different cultures or another demographic gender, ethnicity, etc.

5.2.1. Manufacturing planning and control over sustainable performance

Lean practices for firms are chosen to advance performance because such systems possess all fundamental activities of a company's operations used for planning and controlling manufacturing (Silver et al., 1998). However, a study conducted based on respondents did not support the hypotheses of the significant influence of Manufacturing Planning and Control on a firm's sustainable performance. The limitation and recommendations for this research will be explored in a later section.

5.2.2. process and equipment over sustainable performance

Several leading countries decided to be more endurable companies and embraced many initiatives to enhance the environmental and social performance of their facilities, processes, and products (Fiksel et al., 1999). However, a study based on respondents did not support the hypotheses of the significant effect of process and equipment on sustainable performance. The limitation and recommendations for this research will be explored in a later section.

5.2.3. Human resource practices over sustainable performance

Human resource practices include advancing the performance of an organization by training and developing personal capabilities, for example, skills, understanding, and capabilities (Daniels, 2003), over and above manners, and mindsets (Schuler & Jackson, 1997). Human resource practices positively impact sustainable performance, supported in this study by testing path coefficient and significant level. With better HRM practices, the firm can build the capabilities of its employees to enhance firm performance.

5.2.4. Product design over sustainable performance

Efficient and effective product designs may lean market share or develop new segments. Acquisition in product design has usually tied to a firm's across-the-board performance (Gemser & Leenders, 2001). A study conducted based on respondents did not support the hypotheses of the significant effect of Product design on sustainable performance. The limitation and recommendations for this research will be explored in a later section.

5.2.5. Customer relationship over sustainable performance

The sustainability consideration of customer relationship dealing contains the possibility to make a dedicated customer base employing higher satisfaction, including products and services environment-friendly, and therefore the consumer behavior by social value and reputation of having conscious environment (Antonides & Raaij, 1996). A study based on respondents did not support the hypotheses of the significant effect of a customer relationship on sustainable performance. The limitation and recommendations for this research will be explored in a later section.

5.2.6. Supplier relationship over sustainable performance

Supplier relationship management (SRM) can be considered as an approach to influencing the behavior of suppliers and influencing sustainability practices by working with suppliers in activities like improving operational functions of the organization in warehouses, reducing packaging, using more cost-effective transport, and taking on environmental and social programs requiring all these from supplier’s end (Carter & Rogers, 2008). Supplier relationship positively impacts sustainable performance, supported in this study by testing path coefficient and significant level. With improved supplier relationships, the firm can build a competitive advantage with more cost-effective functions, inventory, and warehousing controls to enhance performance.

5.2.7. Organizational culture that moderates lean practices over sustainable performance

"The attitudes of behaviors observed in perceptions of approaches communicated by team players in particular pathways that assist resolution to resolve the problems faced in the track of a team task" (Nguyen & Watanabe, 2017). This study's supported the hypothesis that organizational culture influences sustainable performance by testing path coefficient and significant level. Developing organizational culture enhances firm performance with effective team working and successful lean practices implementation.

Moderation effect of organization culture over Manufacturing planning and control, process and

equipment, human resources practices, product design, supplier relationship, and customer relationship analyzed on Sustainable Performance in this study. Only supplier relationship with moderating impact of organizational culture towards firm's sustainable performance supported in the study with a negative path coefficient. As this hypothesis tested was not related to the findings present in the previous study due to geographical change or research methodological approach used in this approach. The limitation and recommendations for this research will be explored in a later section.

5.3. Implications

This study explores the positive effect of implementing lean practices on human resources practice, supplier relationships, and organizational culture towards sustainable performance. The findings can be helpful in exploring the literature for further studies. This study has discussed lean manufacturing practices incorporated in manufacturing control plans, process and equipment, human resource practices, customer relationships, supplier relationships, and organizational culture toward sustainable performance in firms from previous studies. Furthermore, the theory and literature discussed are helpful for readers to understand lean practices, organizational culture, and sustainable performance. Theories explored in this study are Relational Coordination and Lean Manufacturing Systems, Incorporating Lean Management theories with DMAIC and DMADV, and Theory of Constraints Incorporating Lean Management.

This study can be helpful in manufacturing firms (HR managers, Supplier relationship management) regarding lean practice implementation in Pakistan. Lean manufacturing is a hot topic, and organizations are focused on this. However, as this research seeks to provide how effective and positive lean implementation is in Karachi, Pakistan, this study has limitations in getting more generalized results. Future recommendations and limitations will be discussed in the coming sections. This study provides in-depth knowledge for stakeholders of the company, how previous study and this study relates lean manufacturing to the sustainable performance of the company. As per respondents of this study, the positive attributes of human resource practice, supplier relationships, and organizational culture enhance the firm's performance in Karachi. Moreover, lean implementation can create competitive advantages for the firm to enhance their productivity along with better customer satisfaction and ultimate objective their profitability.

5.4. Limitations

This research study on lean practices in manufacturing firms with moderation effect of organizational culture has several limitations. Each study has its limitation considering sample size/techniques, methodological approach, item selections concerning latent variables, geographical and cultural attributes, etc. Non-significant hypotheses not supported by the study may have happened. Due to sampling technique, procedures, sample size, appropriate questions (items) and characteristics of sample data collected from the population, and so forth, failed to choose that might correctly gauge the positive approach. Not supported hypothesis is a limitation of study parameters. However, human resource practices, supplier relationships, and organizational culture significantly positively affect lean practices in a manufacturing firm in Karachi, Pakistan confirming sustainable performance. First, this study is conducted under time constraints, has to be completed within provided deadlines, is based on self-funding, and no external sources are incorporated. This study leads to how much stronger self-expertise a researcher holds. Further limitations to this study are related to sampling and geographical constraints limited to Karachi, Pakistan. The first limitation of time constraint leads to sample size and sampling technique, which can affect the results related to hypotheses developed in this study, as one of the critical elements of research is sample have to be an accurate representation of the population. Last but not least sampling approach used in this study is conventional sampling, by incorporating an adequate sampling approach for more generalized results to meet the construct of the study. Research studies with constrained sample size or sampling technique may not truly represent population or theory generalization as data reliability is concerned with capturing accurate population representation from the sample.

5.5. Recommendations

As firms now a day are focusing on lean practices to build competitive advantage to achieve sustainable performance and growth. Future research can be established in a specific industry for the targeted population to meet the research objective, for lean implementation in firms against performance, barriers to lean practices implementation. The study may include moderation and mediation effects over lean practices toward sustainable performance. Lean manufacturing approaches of firms' associations towards sustainable performance may differ depending on the initiative in which lean manufacturing approaches firms operate. Pakistan has not adopted lean very well as the other world does. But companies are showing interest; studies like this and future studies related to lean practices and performance of firms will explore areas for firms to better understand the effectiveness of lean implementations. This study is based on conventional sampling and future studies by targeting a population with longitudinal research study. Better sampling techniques like Stratified sampling or systematic sampling against the targeted population of specific firms will lead to the generalization of results while exploring new demographic and geographical sectors. Likewise, the range of this thesis was the lean practice and the sustainable performance of firms considering organizational culture as moderators. Even hypotheses are not supported to explore the area of research; investigating the factors that restrain the successful implementation of process industries would be of interest to researchers. In addition, further research could be related to the economic effects of broader lean practices implementation in the process industry. As the process industry is leading in the global economies, any slight variation or revision in the production process can have a crucial effect on the real economy and the growth rates.

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Improving Supply Chain Performance: A Case Study of Interwood Mobel

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ABSTRACT

This study aims to determine the impact of variables on the amount of time it takes to order inventory and how supply chain performance can be improved in the company. The paper also encompasses the discussion in which the methods of managing inventory in an organization and minimization of expenses related to stock are highlighted. Moreover, the study discovers the effect of product demand pushed from the consumer end and selling plans on procuring material or inventory stock. In order to conduct the research, a deductive research approach has been utilized through which the variables are being elucidated, and an association between the variables is established to grasp the outcomes. As the data is collected through questionnaires and survey forms from the workforce of the company, the research method has been used quantitative method, and it has assisted in concluding the problem and proposing recommendations. Additionally, the study has also facilitated an understanding of the return on investment that can be attained by restocking the inventory at the warehouse to satisfy customer needs within due time.

Keywords: *Furniture industry, Lead time, Supply Planning, Demand Planning, Inventory management, Transportation, Raw material*

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Improving Supply Chain Performance: A Case Study of Interwood Mobel

1. Introduction

In 1974, Interwood Mobel (Pvt.) Ltd. was established as a private limited liability company. Interwood Mobel (Pvt.) Ltd is Pakistan's most dependable company in manufacturing and marketing premium-quality furniture. On the other hand, it also carries the title of a trendsetter. It is the industry leader in providing variations in the groups of office and home furniture, kitchens, accessories, wardrobes (for clothes), doors (for offices and houses), flooring (for offices and houses), and bespoke furniture, among others. Interwood set foot into the furniture industry as a central market participant and within a short span of period, it expanded its network of offices spread across the country and a retail network consisting of 11 showroom locations. Various showrooms have been established in various cities to suit the needs of customers who shop at various retail outlets. In the Fiscal year 2019, Interwood's newly opened showroom located in the capital city of Pakistan represents a breakthrough moment in the company's history. This showroom is spread up to 55,000 square feet and provides consumers with a superior retail setting while offering a large selection of high-quality furniture. Besides that, it has also broadened its product offerings by allowing greater customization in manufacturing the products. Interwood has also collaborated with international specialists such as Italian architect Alfredo Zengario to continuously modernize a wide range of product classifications through a brilliant product design that captures the target market's attention (Baloch & Rashid, 2022).

Along with increasing its roots in the domestic market, Interwood has also lengthened its reach into the international market to compete on a global scale. In addition to local luxury residential apartments/projects (where people live and work), hospitals, schools, malls (where people shop) and airports; Interwood has also continued to create its mark on a variety of businesses and corporations in the United States, Europe, Middle East and Africa. Interwood is a member of the International Wood Association (IWA). Interwood Mobel (Pvt.) Ltd., which was formed in 1974, has standardized itself as the country's top luxury furniture, home and office accessories producer (Shaheen, 2022). The unique vision Interwood Mobel brings into the furniture industry when it comes to serving its devoted customers distinguishes the company from all of its rivals. The repurchasing and complete end-to-end solutions display the consumers' trust in Interwood Mobel (Pvt) Ltd. When doing research, it is common practice to begin with a problem statement, which is a claim that summarizes the issue that the study will investigate. The problems that the research study has attempted to answer are outlined in further detail in the problem statement below:

The company's inventory includes unprocessed commodities, final products after manufacturing and more. The company has struggled to actively manage the inventories to boost the supply chain activities and lessen the likelihood of an inventory shortfall, which causes postponement in meeting the required amount of stock within due time. Delivering exceptional quality to clients on time is critical in a competitive market where time is of the essence, and on-time production and delivery are critical for success. In production and planning, safety lead time is involved in the structures. Safety lead time is a process whereby purchase orders are launched and scheduled to be delivered one or more periods earlier than required in order to meet production or customer demand (Alrazehi et al., 2021; Anwar, 2022). Obtaining the necessary materials on time and putting them to use before they expire has always been a challenge for the company; with increasing supply and demand, the company's concern has grown and relocated to manage lead time and resource usage better. There has been a reasonable gap in the company's strategy to sustain the supply chain processes as its competitive advantage (Faster & Better) are not achieved combined. The quality of the goods produced is better, but they lack in managing to produce and deliver the better quality faster in time.

As long as the listed complicated matters are intact, the management of Interwood Mobel (Pvt.) Ltd will have to endure either sales loss or client switches (consumers might change their brand and switch towards competitors). In this situation, the company will suffer negatively, so to surpass these odd scenarios, the management at Interwood Mobel needs to plan in such a way that benefits the

consumers and the company itself, as a satisfied customer is one of the keys to success. The purpose of this study was to aid in modifying the supply chain activities at Interwood Mobel to reduce the lead time for delivery to avoid customer dissatisfaction. The study has been conducted to address the impact of delays in the production and delivery processes of goods and services to make a solution available and meet consumer demands through the commitment made by the company. For example, according to past research, lead time is essential for acquiring a competitive advantage over the rivals in the market.

2. Literature Review

Lead time is between an order being placed and the delivery invoice. In contrast, a more detailed description of lead time is the period between an order being prepared by the buyer, being sent or placed, being received by the seller or distributor, being prepared by that provider or seller, being shipped, and being received by the consumer and being compared to the order placement (Amjad, 2022; Rashid & Rasheed, 2022). When applying the definition to service firms, lead time can be defined as the period between the time a customer requests a service and submits a requirement to the supplier, the period that the organization's officers spend working on the request, the period that they devote to making available the resources needed to provide the service and the period they devote to any other activities (Hashmi & Mohd, 2020; Hashmi et al., 2021a).

The primary goal of this phase of the study is to determine the optimal forecasting approach that will work best in the organization and be most beneficial to the business in terms of inventory classification and lead time reduction. Lead time decreases primarily expedite cost reductions, benefit gains, and increased competitiveness are supported by evidence. Reduced Lead Times can result in lower inventory levels and more cash available for corporations to use as needed (James, 2003; Hashmi et al., 2021b). From a number of perspectives, it indicates less risk, exposure, and management of materials and resources. Client time intervals that are shrinking would be a fundamental exception. When the client time interval shrinks, it might result in more trade being won and, at the same time, higher stocking levels being maintained; this is especially true when there is a variation between the Client time interval and, consequently, the Total time interval. The administration of time intervals is frequently viewed as a distinct competitive advantage (Banerjee, 1986; Rasheed, 2022). The ability to provide things or services more quickly than the competition is referred to as time-based competitiveness. Efforts to reduce time intervals are responses to calculated challenges that arise in the areas of procurement, manufacturing, and distribution. An examination of lead times in dispersion frameworks reveals several potential areas for improvement (Victory et al., 2022; Williams & Tokar, 2017).

Items streams are traditionally managed by discrete organizational units that operate independently and are ineffectively assisted by the organization. Rather than being interconnected, value-based frameworks handle information about the time and amount of item streams. This includes the necessity for receptive behavior and the timing of consolidation chances. The use of a lean considering method specifically assists in this motivation and, in a roundabout way, increases the likelihood of achieving optimal request fulfilment and meeting the sales objective (Hashmi et al., 2020a). When innovative lean processes are combined with a prominent marketing display, the supply chain's execution can be significantly enhanced in some instances. Time is of the essence, and clients require shorter lead times. Before the process and post-processing stages, firms evaluate cycle times in production, logistics management, and project planning (Agrell, 1995; Hunaid et al., 2022).

As this research is a quantitative and deductive approach, the technique applied here is (ABC Analysis Technique). The ABC analysis is a method of inventory control that ranks the significance of different stock items according to their potential financial impact on the company. ABC inventory managers rate products on demand, price, and risk data, then arrange items into classes according to those criteria. This enables business executives to better understand which items or services are essential to their firm's profitability (Ali, 2022; Kiani & Sangeladji, 2003). "Class A" items are the stock-keeping units (SKUs) that have the highest significance depending on the sales number or the company's

profitability. "Class B" items are the second-most essential, while "Class C" goods are the least significant. Other businesses may choose a categorization scheme that divides things into more categories than those three (Basit, 2022; Cole & Stuart, 2010).

2.1. Empirical Reviews

There have been a bunch of observations regarding the inventory management systems and management of the overall lead times (from supplier to end-user) in the organizations that made a huge impact either positively (if the management of inventory and lead time is upright) or negatively (if the management of inventory and lead time is inadequate) (Asif, 2022; Hashmi et al., 2020b). The central idea behind this research proposal is to make the management at Interwood Mobel (Pvt.) Ltd about the consequences of not planning fittingly that many other firms have faced, such as IKEA (a Swedish-founded furniture retail company) is currently struggling to supply its customers accurately within the provided timeline. Customer feedback has been observed complaining about the waiting time for the furniture products to be stocked back has increased, which is unsatisfying for the customers. Hence, planning for the inventory according to the forecasted customer demand would positively value the company.

This part of the research initiates the research framework to progress the study. So, the research framework developed for this study is constructed on the following approaches and concepts identified in the literature review. The framework's objective is to clarify the direction of the study, its conceptual logic, and the leading ideas, which helps to explain its concepts briefly. Since the study aims to reduce lead times, the main activities should be discussed first. The investigation stages checklist must be done to finish the study effectively. It is strongly advised that such stages be depicted in the shape of a layout proposed study. (Alam, 2022). Figure 1 illustrates the conceptual framework of this study.

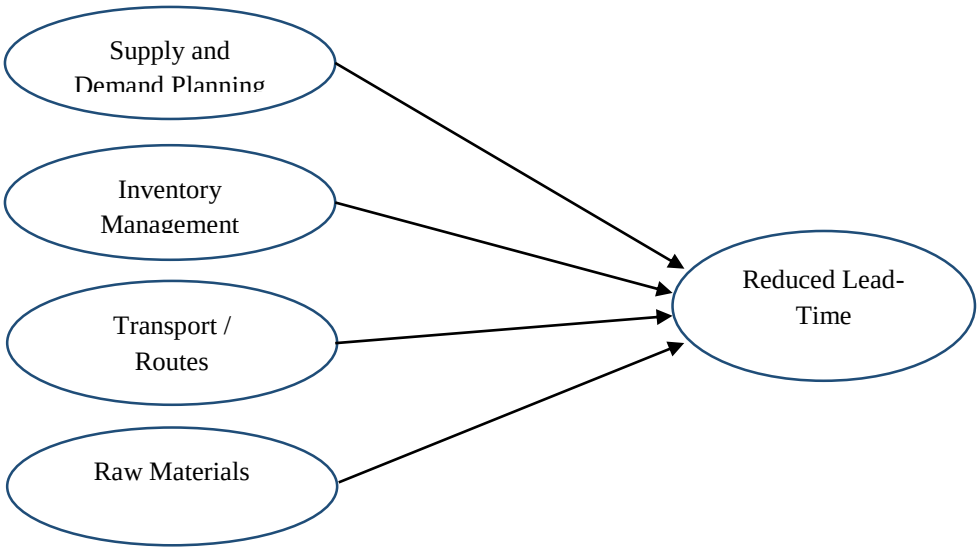

Figure 1: Conceptual framework

In response to the literature, this study aims to identify the factors affecting the lead time, i.e., Supply and Demand plan, Inventory, Transportation and Routes and Raw Materials. So, the complete hypotheses are given below:

H1: Supply and demand plans significantly affect lead times.

H2: Inventory management significantly effect lead times.

H3: Transportation and routes significantly affect lead times.

H4: Raw materials significantly affect lead times.

3. Research Method

A research methodology is a process of choosing a path to do research; whether it is a qualitative or quantitative, deductive, inductive, or mixed method, it is based on the research philosophy. (Khan et al., 2022a; Uddin, 2022). First, it establishes a means by which data will be acquired and specifies the technique used, including a survey, interviews, or direct observation. Second, it involves making an objective evaluation of the population that will be used as the source of the sample that will be chosen to gather the data. This sampling choice must be founded on some justification. Third, it provides information on the construct, such as who built the instrument and whether it was self-constructed or adopted. In conclusion, it describes the technique of analysis, which includes how the collected data will be examined to arrive at a conclusion. This is done by identifying the relationship between the dependent and independent variables (Ayaz, 2022; Khan et al., 2022b; Muzammil, 2022).

The deductive approach has been used for collecting the data in this quantitative research. The deductive method starts with a theory that is explained in past research, then moves on to the development of hypotheses based on that theory, followed by the gathering and examination of facts to test those hypotheses (Barton et al., 2010; Rashid, 2016; Khan et al., 2022c). The research explains the impact of variables affecting the lead time at Interwood Mobel Pvt Ltd. In order to carry out research, the method that has been chosen, which will be deductive, is one in which specific variables are stated. In order to achieve a successful outcome, the link between them must first be created. In order to get to a conclusion about the problem and provide a remedy for it, a quantitative approach is employed to collect data from respondents. The approach used is a business research study, with the study's primary objective being to explain the issue that a particular corporation is facing. The context of research methodologies and procedures chosen by a researcher to perform a study is the proposed study. The design uses scientific methods to fine-tune research methodologies appropriate for the topic area and put their investigations to good use (Haque et al., 2021; Khan et al., 2021; Rashid & Amirah, 2017; Tersine & Hummingbird, 1995).

3.1. Sampling and Statistical Techniques

As the research is a business research-based study, the sampling design depicts the targeted population, the size of the sample to conduct the research and the sampling technique applied for the investigation. In a positivist philosophy, a hypothesis (or hypothesis) is developed based on a testable theory. Then, a study plan is created to examine the hypothesis (Agha et al., 2021; Banerjee, 1986; Rashid et al., 2019). The persons who will be the focus of the study and analysis carried out as part of the interventions make up what is known as the target population. When conducting a cost-effectiveness study, it is essential to provide detailed descriptions of the features of the target population and any subcategories. The selection of attributes is determined by the existing health literature and practices, the research goals, and the contextualized data. Age, gender, and other potential risk variables could be the most important aspects to consider in research on VAD and ECMO (Rashid et al., 2020; Zhao et al., 2013). The data has been collected from the workforces of Interwood Mobel (Pvt) Ltd. working in different departments such as Sales and Marketing, Warehouse and Inventory Management, Supply Chain and Logistics and E-Commerce.

The number of people who participate in or make observations for a research project is the number of respondents. The symbol for this value is often denoted by n. Both of these statistical features are impacted by the size of the survey; 1) the accuracy of our estimations and 2) the value of the research in terms of its ability to make inferences. (Pfeffer & Jarcho, 2006; Rashid et al., 2021). The overall population consists of 98 participants from Interwood Mobel, by whom the data has been collected, and their sample size is 98 (it has been taken randomly from the population). Simple Random Sampling from the Probability Sampling Technique has been utilized to provide an equal chance for a sample to be chosen/selected. Random sampling is a kind of selection in which every subset has an equal opportunity to be chosen randomly. The goal of a randomly selected sample is to accurately reflect the demographic as a whole (Cox, 1972; Rashid et al., 2021). The data collection is based on how to reduce the lead time by classifying the inventory at Interwood Mobel (Pvt) Ltd. The data has been collected

from the Top Tier to First Line employees (working in different departments as mentioned in the target population) of Interwood Mobel, having information on order placing and receiving and those connected to providing the delivery within the lead-time. The data has been gathered from Interwood Mobel (Pvt) Ltd.'s main office located in Karachi and their Warehouse. The source of surveying data in the collection of information has been utilized. The statistical technique used in this research to get the results are; ANOVA: It is used to separate the data on the variance explained into its components so that it may be applied to different tests (Baker, 2018). Regression and correlation: Correlation and linear regression are this study's most widely utilized methods to investigate the relationship between two quantitative variables. Regression represents the relationship as an equation, whereas correlation measures the strength of the linear regression between two variables.

4. Results and Findings

4.1. Demographic Analysis

Based on the above criteria, Male responses received are higher with 65%, whereas 34.7% of the responses are from females. In the responses received from the mentioned genders with percentages, the age group who responded more is between 20-30. As mentioned in table 1, 58.2% of people are the ones who belong to this age criterion, and the second most responsive are from the age group of 41 to 50, as they are 20.4% of the total population. Following the second, the third most responsive age group is between 31-40 with 13%, and the rest are 50 or above with 8.2%. Keeping in mind the education criteria, the group of Graduates are more responsive, with 52% of the total population. In contrast, responses from the group of Postgraduates stand second from the total population with 39.8% and the minor responses are received from the group of Undergraduates. Note that 100% of responses are collected from people currently employed at Interwood Mobel Private Limited.

Table 5: Demographic attributes

Demography	Group	Frequency	Per cent	Valid Percent
Gender	Male	64	65.3	65.3
	Female	34	34	34
Age (Years)	20-30	57	58.2	58.2
	31-40	13	13.3	13.3
	41-50	20	20.4	20.4
	50 or above	8	8.2	8.2
Education	Undergraduate	8	8.2	8.2
	Graduate	51	52.0	52.0
	Post Graduate	39	39.8	39.8
Occupation	Employee	98	100.0	100.0

4.2. Validation of Model

The reliability analysis is conducted by measuring Cronbach's Alpha value, where the minimum value for the data to be reliable is 0.7 of the dependent variable (Hashmi et al., 2021b). In this case, the value for the reliability of the dependent variable, i.e., Reduced Lead-Time, is 0.672 (shown in table 2), which explains that data collected for the study is reliable and can be used for further reliability analysis using Cronbach's Alpha of each independent variable. The reliability statistics of independent variables are also described in table 2, such as the reliability values for supply & demand plan, inventory, transport/routes, and raw material are 0.710, 0.650, 0.699 and 0.758, respectively. The N of items depicts the number of questions asked of the respondents from all variables. Furthermore, to validate the data and align with the sample size, whether it is suitable or whether results can be generalized appropriately or not. The minimum level of the sphericity test is 0.6 (Rashid et al., 2022). Here for our study, the result of the data is found.

Table 6: Reliability analysis

Variables	Cronbach's Alpha	N of Items
Reduced Lead Time	0.672	5
Supply and Demand Plan	0.710	5
Inventory	0.650	3

Transport/Routes	0.699	4
Raw Material	0.758	6

Table 3 displays the total population, i.e., 98 from whom the responses are being collected, denoted by N. The mean and standard deviation of each question being asked in the segments of independent variables and dependent variables, respectively, are exhibited separately. Also, note that the significance value of Reduced Lead-Time is 0.007, Supply & Demand Plan is 0.023, Inventory is 0.031, and Transport/Routes is 0.025. Raw Material is 0.004, meaning that the hypothesis supports the claims and reliability analysis is significant.

Table 7: Standardized beta coefficient

Variables		N	Mean	Standard Deviation	Coefficients		
					Beta	t	Sig.
Reduced Time Lead	RLT1	98	3.53	.998		2.762	.007
	RLT2	98	4.01	.917			
	RLT3	98	3.99	.973			
	RLT4	98	3.86	.963			
	RLT5	98	4.03	1.026			
Supply and Demand Plan	SDP1	98	4.03	.956	.307	2.324	.023
	SDP2	98	4.05	.813			
	SDP3	98	4.15	.917			
	SDP4	98	4.06	.982			
	SDP5	98	4.03	1.061			
Inventory	INV1	98	3.81	1.003	.260	2.196	.031
	INV2	98	4.00	.890			
	INV3	98	4.01	1.015			
Transport/Routes	TR1	98	3.90	1.000	.011	2.094	.025
	TR2	98	4.08	1.002			
	TR3	98	3.93	.955			
	TR4	98	3.99	.947			
Raw Material	RM1	98	3.69	1.183	.202	2.790	.004
	RM2	98	3.94	.921			
	RM3	98	4.09	.887			
	RM4	98	3.85	1.040			
	RM5	98	3.84	1.010			
	RM6	98	4.21	.776			

Note: (dependent variable = reduced lead-time)

Tables 4 and 5 display the statistical technique applied during this Quantitative research, i.e., Regression Analysis. It is a model summary showing the R square and its adjusted value, which helped explain the reliability and the positive relationship among variables. The variation caused by the independent variable in the dependent variable is around 45%.

Table 8: Regression analysis (adjusted R square)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.673[a]	.453	.425	.45363

Note: a. Predictors: (Constant), RM, TR, INV, SDP

Table 9: ANOVA (regression model)

	Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	13.459	4	3.365	16.351	.000[a]
	Residual	16.257	79	.206		
	Total	29.716	83			

Note: a. Predictors: (Constant), RM, TR, INV,SDP; b. Dependent Variable: RLT; The significance or p-value in the above table of ANOVA is .000, which is less than .05, showing that the model is fit and significant.

The supply and demand plan positively impacts the reduced lead time and its significance, whereas the Beta value is .300, T-value is 2.324, P-value is 0.23, and the results are supported. Inventory positively impacts the reduced lead time and significance, whereas the Beta value is .212, T-value is 2.196, P-value is 031, and the results are supported. Transport/routes positively impact the reduced lead

time and its significance, whereas the Beta value is .009, T-value is 2.094, P-value is 0.25, and the results are supported. Raw material positively impacts the reduced lead time and its significance, whereas the Beta value is .201, T-value is 2.790, P-value is .004, and the results are supported. All hypotheses were supported and had a positive impact on the given study. Summarizing the hypothesis testing defines that all independent variables such as Supply & Demand Plan, Inventory, Transport/Routes and Raw Material denoted by H1, H2, H3 and H4, respectively, support the dependent variable Reduced Lead-Time.

Table 10: Hypothesis testing

Relationship/hypothesis	Beta	T-value	*p*-value	Results
H1: SDP→Reduced Lead Time	.300	2.324	.023	Supported
H2: INV → Reduced Lead Time	.212	2.196	.031	Supported
H3: TR→ Reduced Lead Time	.009	2.094	.025	Supported
H4: RM → Reduced Lead Time	.201	2.790	.004	Supported

Source: SPSS output

5. Conclusion, Discussion, Implications, Limitations and Recommendations

This study aimed to identify the relationship between demand and supply plan, inventory, Transport/routes, raw material and reduced lead time of products that are directly related to the supply chain performance of Interwood Mobel Pvt Ltd. Furthermore, Reduced lead times specifically expedite cost reduction, provide benefits, and increase competitiveness, (Boonsthonsatit & Jungthawan, 2015). Moreover, it was noted that the inventory was not being refilled or kept in the warehouse, which increased the lead time and often resulted in reduced sales. In addition, this research has given particular attention to stock categorization and firm supply chain operations. Streamlining processes and boosting productivity can increase output and revenue. Longer waiting times, however, have a negative impact on sales and production activities and customer satisfaction as well; reduced lead time has a positive impact on customer satisfaction (Das et al., 2021).

5.1. Discussion

Discussion engages the readers in the analytical analysis of issues based on an evidence-based interpretation of results; it is not rigidly bound by objective information delivery (Mitchener & Basturkmen, 2019). There will be a split of inventory in the warehouse's bisection, which indicates that while the inventory for the lucky one showroom will also be kept in the same warehouse, it will also be accessible for the Bukhari showroom. Internal communication must be on such a fast track that the movement of inventory is visible to decision-makers, as a consequence of which any unexpected demand or correction within a product by a consumer may be dealt with appropriately within a brief period whenever a customer's requirement arises. It can also be appropriately handled in a product (customer-requested change) in a relatively short period. Timely shared data at the right moment can help to decrease product delays.

It is the responsibility of the firm's top management to ensure that the sales team shares sales data with the production team at the appropriate time in order to avoid any type of delay in the product's structure and that the production department is completely obvious on key questions such as what to produce, where to send the product, and how much items are needed. If the firm takes steps to reduce lead time, it must employ cross-dock transportation to deliver finished items. This will raise transportation costs, but the reduction in lead time will be noticeable, and the ultimate goal of on-time delivery of the product will be met. Because Interwood relies on responsive transportation behavior, it must construct a cross-dock transportation system to deliver finished items. Using a local supplier can affect the quality of the materials because the company currently uses imported materials to create their product offerings, which raises the cost of the product. If local suppliers are associated with the firm, the quality of products will be compromised, but the cost of the product will also be reduced so that it can gain a good profit due to its brand image. Making decisions about the inventory can benefit by categorizing the product into classes like A, B, and C, which will give a clear image of the fast-moving inventory, fair movement of inventory, and slow-moving items or dead stock.

5.2. Implications

Interwood Mobel must classify the equipment to segregate and arrange them in terms of precedence, which will help facilitate decision-making. The storage division needs to be divided into two areas so that one can accommodate LuckyOne Showroom's needs and the other can accommodate Bokhari Showroom's needs. It is proposed that adopting and incorporating the said structure into Interwood Mobel's procedures would be novel for them, and an explanation is also provided for it. The study provides good results for the industry experts, specifically the management of Interwood Mobel, for effectively managing their demand and supply plan, inventory, Transport/routes, and raw material so the lead-time can be reduced and supply chain performance can be improved. In the conclusion of the research, which showed that inventory management substantially impacts supply chain performance overall, management should concentrate on bolstering it more to gain a competitive edge or save expenses associated with inventory and material handling. It also emphasizes the significance of lead time.

5.3. Limitations and Recommendations

The study's conclusions are constrained from several angles, including sample size restrictions, geographical reach, respondents' degree of comprehension of the value of the research process, and the organization that was intended to be the project's target group. Results cannot be extrapolated to other large-scale and Pakistani businesses. We recommend Interwood Mobel categorize the materials so that the inventory is separated and set up in a priority sequence, making the decision-making process more accessible. Therefore, we must partition the warehouses into two spaces, one of which must serve the demands of LuckyOne Showroom and the other of which must serve those of Bokhari Showroom. We have also justified it because we understand that it will be something new for IWM to adopt and incorporate into their process. We will be able to determine the product demand at each showroom once we put our new strategy into practice, allowing us to estimate future orders so that they may be created and restocked as soon as possible to reduce the lead time (Banerjee, 1986). Enhance Internal Communications: The warehouse's replenishment process has to work effectively together internally in order to avoid causing unforeseen delays. In order to avoid unanticipated delays in the restocking of class A and class B, the fast-moving product and Interwood warehouse should effectively interact with the manufacturing and sales departments through the ERP system. We can advise them to work on their ERP software in other statements. It was noted in the discussion above that the forecasted data and actual data differ from one another (the unit forecasted vs the unit sold are different), so they can work on visualizing the data to make appropriate decisions on time.

Cross-dock Shipment: Interwood's main problem, which several sources have brought up, is its long lead times. We advise the company to concentrate on cross-dock shipments by handling multiple orders from clients effectively, which will impact the cost of transportation, boost profitability, improve customer satisfaction, and shorten lead times. Provide Sale Forecasting: Interwood should share the sales data timely with the production department, which helps them to anticipate the needs and speed up the fulfilment process. Utilizing local suppliers: Interwood currently purchases its materials from foreign suppliers, which results in lengthy supply chain lead-time due to distance, shipping, port formalities, and then land transport. To avoid these hassles, the company has formed strategic partnerships with local supply chain partners who can maintain inventories and provide as necessary.

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Factors Affecting the Supply Chain Resilience and Supply Chain Performance

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ABSTRACT

The key objective of this research study is to delve into the factors affecting supply chain resilience to enhance supply chain performance through the mediation of supply chain resilience. To perform this particular research, a quantitative method of research was applied. The process of data collection was performed by using the questionnaire technique. As it was impossible to collect data from every member of the targeted population thus, a sample of data was calculated using G*power software and obtained a sample size of 129 respondents. It was concluded that supply chain artificial intelligence, adaptive capability, and supply chain collaboration have a positive and significant influence on supply chain resilience and supply chain performance. At the same time, supply chain resilience also has a positive impact on supply chain performance. Thus, organizational and supply chain performance can be enhanced by adopting supply chain resilience and other organizational dynamic capacities. This particular research study provides insight to the practitioners and managers of manufacturing firms for improving their level of resilience in the supply chain. This specific research study plays a significant role in literature by highlighting the concept of supply chain resilience & supply chain performance of organizations.

Keywords: *Adaptive capability, Artificial intelligence, Supply chain collaboration, Supply chain performance, Supply chain resilience*

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Factors Affecting the Supply Chain Resilience and Supply Chain Performance

1. Introduction

At present times, every organization is at risk due to the conditions of disruptions (Chaudhuri et al., 2018). The firm's resilience is defined as a capability and competency of an organization to effectively handle unexpected and unforeseen situations that always act as a central element for the firm against any disruptive condition (Cheng & Lu, 2017; Shaheen, 2017). On the other hand, over time, the types and number of disruptions and challenges for businesses are increasing day by day, due to which the concept of resilience is gaining more attention for its adoption and have a great level of significance for organizations ad their management of supply chains (Fattahi et al., 2020). The disruptive supply chain of organizations may disturb the flow of services and products that the organization offers to their customers (Olivares-Aguila & ElMaraghy, 2021). Therefore, disturbance in the system of the supply chain can impose a negative impact on the performance of the firm in terms of lowering the level of stock returns and the firm's competitive position in the business environment (Ivanov & Dolgui, 2021).

Several disruptive events break down the continuous follow of products and services offered by the firms. Global supply chains faced disruption by several events, including the financial crisis of 2008, and 2016, the United Kingdom's decision to leave the European Union (Brexit), and the recent worldwide pandemic of Covid-19. Therefore, to handle disruptive conditions, the concept of supply chain resilience has gained considerable attention from practitioners (Queiroz et al., 2020). The many kinds of literature based on big data analytics have established the utilization of predictive analytics for discovering the sources that cause disruptions that ultimately improve firms' supply chain systems through resilience (Choi, 2020). The organizations need to develop analytical proficiencies to increase the resilience in SC through the effective utilization of knowledge of the resident firm; in that way, organizations can strengthen their existing abilities of information (Scholten et al., 2019; Wong et al., 2020). Supply chain firms are highly investing in enhancing the level of resilience in their systems by raising the capability to manage disruptions (de Sá et al., 2019) and the nonstop flow of critical supplies (Hendry et al., 2018). Effective capabilities of SC firms include forecasting and proactive management of SC threats and disturbance-creating factors and events (Baryannis et al., 2019).

Several studies found a positive relationship between the information, business, engineering, and analytics to build digitalization and risk of SC. Several developing technologies have the potential to enhance supply chain resilience and also have the competency to predict the SC risk through advanced product tracking applications, Artificial intelligence, industry 4.0 & additive manufacturing (Ivanov & Dolgui, 2021). In past research, many studies displayed the technique of AI as very encouraging and helpful in supporting effective decision-making within the SC and building proactive and analytical competencies (Belhadi et al., 2020; Dhamija & Bag, 2020; Anwar, 2022). The recognized perspective of AI to support the process of decision-making in SC activates an insightful reflection on how artificial intelligence can be utilized at a high level for accomplishing long-term & competitive performance in the supply chain in terms of innovation (Akter et al., 2020; Amjad et al., 2022). Whereas, previous research studies debated and claimed that process innovation religiously supports the concept of resilience in the supply chain while facing -an uncertain condition that ultimately results in enhanced supply chain performance (Akter et al., 2020; Kwak et al., 2018). Emerging innovation driven through artificial intelligence is more beneficial as it may speed up the decision process in prototyping, identifying, and testing solutions to disruptions (Paschen et al., 2020). This kind of decision process is an innovation that researchers call a design. The influence of invention that emerges through AI technology mainly strengthens the SC through sharing information, information processing & integration that exist in a firm's system has long been viewed as a complex factor in constructing supply chain resilience and enhancement of enhancing SC performance (Fosso Wamba & Akter, 2019; Rasheed, 2022). Existing research studies displayed that procedures of AI have been successful in encouraging innovation that offers solutions that ultimately lead to the enhanced firm's SC performance (Baryannis et al., 2019; Dubey et al., 2020).

In current situations, the concept of supply chains plays an immense role in changing technology and the business atmosphere. A continuous flow of information is essential for operating supply chains in a vibrant environment with many external and internal threats that continue to overpower and destroy the level of performance (Belhadi et al., 2021). Moreover, the researchers; Dubey et al. (2020), and Fosso Wamba and Akhter (2019) have identified the environment's vitality as a complex factor to be studied while handling the issue related to performance. As previously, the researcher didn't test the overall model's connection among artificial, adaptive capability, and supply chain collaboration with each other and its impact on supply chain resilience. To the best of our information and knowledge, this is the first research study that empirically examines the impact of Artificial intelligence on the performance of the supply chain by studying the mediating influence of supply chain resilience. This research study will consider these market uncertainties as a problem statement. To resolve this problem, the author will incorporate the concept of supply chain resilience; the main focus of this research will be to analyze the factors behind supply chain resilience and how it enhances supply chain performance. Therefore, the study will seek answer to the question of, Does the artificial intelligence, adaptive capabilities, and supply chain collaboration have significant effect on supply chain performance through supply chain resilience?

2. Literature Review

2.1 Dynamic Capability View Theory

DCV is a great tool to analyze the resilient potentiality required in awakening the tumultuous consequences, an addition of the RBV. The RBV emphasizes that the firm needs to evolve capacities to defeat trouble and to attain competitive advantage (Hashmi et al., 2021a). Nevertheless, a tradition of lacking a proper definition of capacities is set due to the occurrence of dynamic changes in changeable environments. A customary gap in RBV is addressed by DCV using designing adequate capabilities and resources to retaliate to the specific situation changes. Whereby, covering the mannerism of eventualities. Capacity and capability of a firm to construct, incorporate and rearrange firms' resources by applying the procedures adopted by the firm to tackle the environmental uncertainties and alterations and to outline new strategies of value-creation. An argument can be put forward that supply chains of firms need to develop or evolve dynamic capabilities to lessen the exposure in a changeable environment, which demands flexible capabilities for long-term survival. From the standpoint of DCV, the responsive and proactive capacities and capabilities of the SCRE can be elaborated. DCV necessitates that the organizations must bear the capacity and capability to incorporate, adjust and rearrange their resources and potentiality to deal with quickly altering environments. Proactive scanning concerning environmental changes and attaining requisite adaptability and flexibility should be accelerated by the firms (Rashid et al., 2022a). According to our study, is proportionate with the prevention of possible exposure in the supply chain and the proactive capacity of the supply chain to adjust environmental alters. In their findings, Hashmi et al. (2021b) emphasize that companies which are successful in the marketplace should rearrange their capabilities and resources speedily to retrieve capabilities during disruptive times. According to our argument, the reactive capability to rearrange facilities or amenities and competencies is essential to have for speedily recovering from disturbance.

The idea of "balanced resilience", is fundamentally the steadiness among raising costs to control susceptibilities and raising resilience capabilities. Based on the DCV, the significance of capacity/resource particularly and appropriate quantification to maintain lucrativeness by enhancing the flexibility balance. However, the existing literature furnished a model for resources, particularly of SCRE, the principles of resource quantification for SCRE are until now non-existent (Rashid et al., 2023). The fundamental assumption of this study is to enlarge the quantification aspect of dynamic capacities and elaborate on the circumstances of SCRE to fight obstacles arising from environmental unpredictability. It has been proposed in this study that measurement and description of dynamic capacities in conditions of responsive and proactive capabilities concerning SCRE. Therefore, this work supplied an important extension of the dynamic capacity hypothesis.

2.2 Supply Chain Resilience

The concept of resilience in the supply chain is defined as the capability that deals with uncertain and unexpected disruptive events. It also plays a role in recovering the disruption and quickly converting it into the original performance level or a new level that is necessary to maintain the anticipated market, financial and operating performance of the supply chain (Adobor, 2020). For the formation of resilience competencies and capability in the system of the supply chain, it is important for the firms to recognize and evaluate the nodes for risks and their strength of effects and chances of occurrence and how these uncertainties and risks can be identified (Chang et al., 2015; Dubey et al., 2018). Organizations adopt multiple techniques and strategies to maintain resilience in their supply chain system. Through some supply chain systems, in the starting period of the COVID-19 pandemic, the buffers of inventory and capacity were recognized as a cause of resilience on the other hand, other firms have used capacity of production that is underutilized for other products and medicines (Queiroz et al., 2020; Wong et al., 2020; Victory et al., 2022) as compared to a single source of supply, organizations with multi sourcing strategies achieved benefits from the element of resilience (de Sá et al., 2019).

2.3 Artificial Intelligence

For the last two decades, several firms in the business world are trying to adopt digitalization and advanced technologies in their processes. In recent times the application of industry 4.0 arise in the market of businesses (Wollschlaeger et al., 2017). Likewise, Artificial intelligence is the technique that has been identified and recognized as a valuable technology that can enable an effective level of communication aim between machines and certain devices used in firm processes and functions (Guzman & Lewis, 2020). As the system of supply chain consist of various complex tasks in that situation artificial intelligence has been utilized in firms to simplify operational activities by resolving issues by improving the speed and level of accuracy during the handling of a large amount of data and information (Schniederjans et al., 2020; Hunaid et al., 2022). The application of artificial intelligence is not new in the business market but its potential and capability have been recognized recently in the past few years. AI has the capability and competency to make agile & smart decisions in the system of SC for avoiding issues and also for resolving them. Therefore, a very effective system of AI helps firms enhancement of service quality & serving customers through safe and on-time deliveries of products and services (Schniederjans et al., 2020; Toorajipour et al., 2021). The application of AI facilitates a firm through computerized compliance that in response results in the minimization of cost and efficient performance of the firm through adding value to the network of the supply chain system (Treleaven & Batrinca, 2017; Ali, 2022). Artificial intelligence also has a positive influence on improving the predictive competencies that are necessary for estimating demand. Through the bots of AI, the engagement of customers as communication can be initialized. Through these bots, organizations can easily track the status of product deliveries and it further helps customers in engaging themselves with a team of customer support (Huang & Rust, 2021). Through automation AI application help in simplifying the deadly tasks of warehouse operations. To improve the efficiency and effectiveness of the supply chain system well-known companies like Alibaba & Amazon are using it to increase the level of productivity. In the field of the supply chain, every minute has great importance and the application of AI uses algorithms that efficiently support the supply chain systems by minimization of cost and time laps by improving deliveries and routes (Wen et al., 2018; Alam, 2022).

2.4 Supply Chain Performance

In recent time a change has been observed in business to provide more choices to consumers by increasing the service offerings and product that generates further chances to overtake rivals (Um et al., 2017; Rasheed et al., 2022; Asif, 2022). Thus, this trend has been focused on by both practitioners and academics to enhance supply chain performance (SCP). The researchers claimed that the partners of the supply chain requisite to perform together to react to the modifications in requirements of customers. Moreover, even in the literature, it came into consideration that it is important not only to determine the method in which the partners of the supply chain are dynamic or energetic, but also the

method at which they struggle for consistency (Rashid & Amirah, 2017; Uddin, 2022). Moreover, for producing the element of value addition, the supply chain is an essential domain for any business firm. The element of value is added only when an improvement is observed in the performance of SC processes. In the system of supply chain management, value is generated through the implementation of coordination at a wider range (Rashid, 2016). While comparing the benefits of an enhancement in the performance of the supply chain the researchers claimed that the delivery process of products and the level of production were influenced because of increased labour cost & cost of raw material, increased manufacturing cost and also prolonged delivery of products and increase in the level of inventory. Following are the researchers Hashmi and Mohd (2020) that has explained the concept of supply chain performance as the selection of certain function that plays an important role in the performance of a supply chain system. For the aim of this particular research study, the performance of the supply chain can be explained as the capability of SC to perform activities cost-effectively but also to decrease costs for effectively meeting the needs of customers (Rashid et al., 2022b; Ayaz, 2022).

2.5 Hypothesis Development

2.5.1 Artificial intelligence, supply chain performance, and supply chain resilience

The researcher Grover et al. (2020) stated in a research study that the utilization of the technique of artificial intelligence results in the enhancement of the supply chain system. Further researchers argued that it also plays an important role in increasing the quality level of products, enhancing the satisfaction of the customer and also playing its part in the design & development of firm products and processes. Utilization of artificial intelligence results in improved operational performance of the organization than the engagement of the firm. In addition, Klumpp (2018) shows that integrated supply chain systems driven by artificial intelligence like self-driving systems, have a great effect and positively demonstrated that AI-driven SCI, such as self-driving systems, have great potential to encourage the performance of firm logistics and its functions of transportation. It is demonstrated in previous research studies that research frameworks based on artificial intelligence also support the decision-making of extensive distribution. Bottani et al. (2019). Related to this researcher argues that the 56% that occurs due to the out-of-stock situation is minimized because of the implementation of artificial intelligence. Moreover, the author like Dubey et al. (2020) explained that the technique of artificial intelligence arguably enhances the performance of an organization. According to the prospect of organization information processing theory (OIPT), we suggest that the implementation of artificial intelligence (AI) allows the supply chain to develop capabilities that are related to the processing of information (Srinivasan & Swink, 2018; Hashmi et al., 2020a). It permits them to interpret and allows them to acquire knowledge from complex info that is collected from several sources to reduce the chances of uncertainties in demands, availability of supply and capacities (Grover et al. 2020). Else, firms are forced to contain a great level of inventories or depend on human capabilities that are limited to compose a reactive supply chain that as result affects the profitability of the firm and speed of implementation (Dubey et al., 2020; Hashmi et al., 2020b). Overall, such conceptions and evidence of the adoption of artificial intelligence can be considered as the tool that effectively improves the performance of the supply chain. Hence a hypothesis proposed that:

The field of supply chain management is considered the most challenging domain that emphasized the interaction between different departments of the firm such as production, logistics and marketing. Thus success in the supply chain system mainly relies on the success of overall business sectors. As business practices are shifting continuously toward the lean practices and JIT phenomenon so various organizations are implementing this philosophy in logistics, operations and other globalized events such that numerous natural tragedies and unstable political environments, etc. To mitigate these challenges and issues, supply chains implement the concept of supply chain resilience in their systems to effectively deal with uncertain conditions (Hashmi et al., 2022a). In previous years, the technology of artificial intelligence has been introduced which proved itself to be valuable and very much important for supply chain systems. The technique of artificial intelligence is explained as the capability of a computer to freely and self-sufficiently resolve issues that they have not openly planned to address. According to previous research studies, the utilization of AI techniques will boost the economy to

around 13 trillion by the year 2030 and effectively boost the GDP of the world by about 1.2% each year. For several supply chain operations, practitioners used AI techniques in their firms. Most particularly, it facilitates organizations by making practical decisions. With time the AI technique is used for inventory management, demand forecasting, risk management & sustainable SCM. In addition, the researcher further explained that the tool of artificial intelligence also plays an important role in uncertainty and disruption like covid-19 (Lai et al., 2020).

In forecasting and projection, Artificial Intelligence is used effectively and efficiently. Organizations have a long-lasting wish to maintain both the demand and the supply. As artificial intelligence (AI) predicts the data, and automatically analyzes or processes the data or situation, a reliable and exact forecasting demand that the AI delivers. AI permits organizations to enhance their validation in the processing of orders and purchases thus, the minimization cost related to supply chain administration, warehousing, transportation etc. Additionally, it recognized the configuration and trends which assist in designing superior strategies related to retailing and manufacturing. For instance, most businesses use this tool in many ways like, they keep or stocking a specific amount of a particular product that they will sell out and also reduce waste. Artificial intelligence has given the permit to the manufacturers to incorporate in production as well as client feedback to improve the design of the product in real-time. The tools that are based on artificial intelligence provide supreme accountability in the supply chain. As, AI assists them in fast growth as they can improve or enhance the efficiency of engineering, prohibit faults, can shorten the phases of development and also increase safety by determining risky activities automatically, fall in the cost of inventory due to effective planning of supply and demand, it also increases the revenue with the great rate sales which directs to the optimization of price and also to the determination and so on (Rashid et al., 2020). Therefore, we hypothesized that

H1: Artificial intelligence significantly influence supply chain performance.

H2: Artificial intelligence significantly influence supply chain resilience.

H8: Adaptive capability significantly mediates the relationship between artificial intelligence and supply chain resilience.

H9: Supply chain resilience mediates the relationship between artificial intelligence and supply chain performance.

2.5.3 Adaptive capabilities, supply chain collaboration, supply chain resilience, and supply chain resilience

The adaptive capability of a firm is defined as the maximum speed at which it can change its suggested portfolio. The maximum speed of change driven by the adaptive capacity of the firm might differ from the noticeable speed of change. The firm capability accounts for the ability of an organization to perform certain tasks and duties (Eshima & Anderson, 2017; Baloch & Rashid, 2022). The researchers & practitioners related to the adaptive capabilities to agility, flexibility and (Appelbaum et al., 2017; Koçyiğit & Akkaya, 2020; Park & Park, 2021). Adaptive capability is related to the concept that how speedily a firm is capable to variate its suggested portfolio to adapt according to the shifts of the environment. For maintaining environmental resilience, supply chain systems need to build their capacity through the management of adaptive strategies. the management of adaptive strategies delivers a framework for learning and understanding a system in a manner that effectively helps firms the enhancement of capacity for reducing and identifying uncertain and unexpected situations (Alzoubi & Yanamandra, 2020). Adaptive management strategies aim to build the capability to restructure the system in response to changing disruptive conditions (Um et al., 2017). The basic part of the management of adaptive capabilities involves a frequentative process of making decisions that are built to recognize and minimize uncertain and surprise events (Eshima & Anderson, 2017). The researchers Scholten et al. (2019) and Jain et al. (2017) claimed in their studies that the resilience of the supply chain is relatively based on adaptive capabilities. It reduces the influence of unpredicted happenings by

the preemptive recognition of strategies that allow the SC to adapt to the recovering after-effects and also improve the level of prior situations. Adaptive responses as well as adaptive planning both are dynamic factors in developing resilience in a supply chain which assists according to the urban perspective to adjust any uncertain condition. Moreover, the positive influence of adaptive capabilities in developing resilience in the supply chain through reducing the possibilities of challenging unscheduled events, and also it responds through preemptive plans to overcome the shock and reconstruct the state of the operations that is vigorous in the SC.

In the literature of previous research studies, it is simplified that to perform competitively in the business world, firms must have enough knowledge and information about the innovations and external business atmosphere. An open innovation-driven adaptive capacity act as a main conception that clarifies that an organization adapt strategies and other related things to be competitive in the market. The literature of earlier studies highlights the adaptive capabilities and collaboration of SC to be the most influential elements that are required to build supply chain resilience (Scholten et al., 2019; Jain et al., 2017). The term collaboration is defined as the ability to effectively perform working activities with other organizations. It also acts as a method and tool for developing the capacity of the supply chain for regeneration and growth (Tarigan et al., 2021). The concept of collaboration enables the members of the supply chain to effectively perform their tasks and also helps the firm efficiently deal with the problems that a firm cannot handle when it's operating alone in the business market (Ho et al., 2019). The practice of collaboration builds an adaptive capacity in the supply chain system and facilitates the firm through the creation and transfer the information throughout the system of a supply chain that enables the firm and its members to support each other while facing any disruptive situation (Basheer et al., 2019; de Sousa Jabbour et al., 2020). It also helps in avoiding disruptive situations and other issues through effective information sharing, using the strategy of mutual decision-making, arrangement of incentives & collaborative communication (Duong & Chong, 2020). The process of collaboration is the activity in which several individuals and departments work together to achieve the same goal and objective. In the field of supply chain management, it is essential to organize and arrange the activities, work routines and processes of the individual organization correspondingly to gain the proper benefits of collaboration (Alzoubi et al., 2020). Specifically while addressing the occasion or events of disturbance and disruption the element of resilience in the supply chain system cannot be accomplished until & unless firms collaborate in a very vibrant and synergetic way to respond effectively (Al-Doori, 2019; Jadhav et al., 2019; Um & Oh, 2020). This particular statement highlights the importance of collaboration which is very essential for achieving resilience in the supply chain. Therefore, it is hypothesized that:

H3: Adaptive capabilities significantly influence supply chain resilience.

H4: Adaptive capabilities significantly influence supply chain collaboration.

H5: Supply chain collaboration significantly influence supply chain resilience.

H10: Supply chain collaboration mediates the relationship between adaptive capability and supply chain resilience.

2.5.6 Supply chain collaboration, supply chain resilience, and supply chain performance

In earlier research studies, Alzoubi et al. (2020) explained that the concept of collaboration in the supply chain has been considered a priority in many manufacturing firms operating all over the world. In the literature of previous studies, it is mentioned that the SC collaboration has many benefits provided to the firm in the form of minimization of cost, increase in profitability, controlling inventory level and exact estimation or forecast of demand and supply (Al-Doori, 2019). Moreover, it is believed that the collaboration in supply chain plays a significant and positive role in the enhancement of supply chain performance. The researcher Jain et al. (2017) agree and added his statement that integration and collaboration in processes and activities of the supply chain generate benefits that include lessening lead time, minimizing the bullwhip effect, formation of distinctive and unique capabilities, enhancing the

level of flexibility, increase the satisfaction level of customer, enhance profitability and market share of the firm. But many organizations genuinely realized the need for collaboration among SC members (Adhikari & Bisi, 2020; Agyabeng-Mensah et al., 2020; Busse et al., 2016). Perhaps, many firms fail to build collaboration among SC members because of unwillingness to share quality information but apply effort and make a heavy investment (Ali & Haseeb, 2019). This kind of resistance destroys and minimizes the level of trust and commitment that is an essential part of collaboration in the field of supply chain and therefore the performance of SC. This situation shows and highlights the importance of commitment and trust to enhance the performance of the supply chain and develop the element of collaboration in SC (Wang & Hu, 2020). According to the perspective of small and medium enterprises, the factor of collaboration also has a positive impact on the performance of the supply chain. Thus we propose a hypothesis that

A supply chain network with an element of resilience in its system allows it to enhance the capabilities of an organization to face the disruptive situation. A resilient supply chain network also help firms to quickly respond to disruptions and recover them to normal condition which ultimately helps firm enhance their performance (Adobor, 2020; Scholten et al., 2019). It is clear from the existing literature that the firm which takes more time to respond to any disruptions incurs a great level of damage that result in a low-performance level of a firm. Moreover, in another research study, the phenomenon of resilience that relates to the concept of services in 3pl firms, the research found a positive impact on the performance of services. It can be claimed that the organization with more resilience in its supply chain system perform better to detect the main risks and threats that a firm face in the market. Moreover, it is found in many studies that the factor of resilience in the supply chain is positively associated with a high level of firm performance that occurs in terms of achieving competitive advantages and enhanced profitability. Through resilience, the organization also receive an element of customer satisfaction that they considered important performance outcomes (Govindan et al., 2015; Rashid et al., 2019). Moreover, resilience in the supply chain system of a firm acts as a capability and competitiveness that enables the firm to recover from the situation after a disruptive situation (Gligor et al., 2019). Thus, in various previous research studies, it is claimed that the concept of resilience in the supply chain plays a huge role in increasing supply chain performance (Gölgeci & Kuivalainen, 2020; Alrazehi et al., 2021; Muzammil, 2022).

H6: Supply chain collaboration significantly influence supply chain performance.

H11: Supply chain resilience mediates the relationship between supply chain collaboration and supply chain performance.

H7: Supply chain resilience significantly influence supply chain performance.

H12: Adaptive capability and supply chain resilience have sequential mediation between the relationship of artificial intelligence and supply chain performance.

H13: Adaptive capability, supply chain collaboration, and supply chain resilience have sequential mediation between the relationship of artificial intelligence and supply chain performance.

3. Methodology

The research approach stated the plan n procedure of a research study that research is going to conduct or explore (Rashid et al., 2021). There are two research approaches which include the quantitative approach and the second is a qualitative research approach, while the third approach is the combination of both approaches. The objective of the qualitative study aimed to discover new perceptions/theories, whereas, in the quantitative approach the researcher is going to work with existing theories and test these theories to test the relationship among various variables. In a qualitative study, the data is collected by interviews, while in a quantitative study; data can be collected by experiments, surveys, questionnaires and observations. Moreover, in a quantitative study, data collect in numeric

form. As the present study was also based on the existing theories to analyze the relationship among several variables and the data was also collected by using a structured questionnaire and using survey technique. So this study adopts the quantitative research approach because the objective of a quantitative study is to test the existing theories (Das et al., 2021; Khan et al., 2022a; Basit, 2022). Data collection source highlights the nature of data which means how the researcher gathers data for research. These data collection sources are divided into two major types, one is the primary source and the other is a secondary source of data collection (Khan et al., 2022b). The primary data is termed as the newly collected data, while the secondary data has already been recorded for some other purpose. Further, primary data can be collected through experiments, observations, questionnaires, surveys and interviews with the individual respondent. On the other hand, the secondary source includes books, journals, annual reports and other internet sources. In this study, the data was collected by using primary sources and a survey questionnaire technique was used to gather data.

The population of the research study referred to a whole pool of individuals related to a specific sector. Asiamah et al.(2017) stated that the population has three types which include the general population, the target population and the accessible population. The entire pool of individuals related to the selected sector/industry is termed the general population, whereas, the targeted population stated those individuals who are most related to the research objective. The researcher also describes the accessible population which means those individuals who can easily participate in research by adding his/her response. In the current study, the general population contain whole individuals related to a selected sector i.e. employees related to manufacturing firms. This general population has narrowed down to the target population which is closely related to research objectives i.e. in the current study employees are related to the supply chain department in manufacturing firms. Moreover, the accessible population contain the reachable and feasible individuals who will participate in this study which includes the employees working in the pharmaceutical sector.

3.1 Sample and Sampling Procedure

The collection of data from the whole target population is not possible and feasible because it takes too much time and money. So to cope with this problem, the author suggested taking a sample from the target population that represents the whole population. However, there are two major techniques for sampling; these two techniques are probability sampling technique and non-probability sampling technique. Probability sampling is based on the pre-defined chance of choosing respondents for the sample while in non-probability sampling all individuals have an equal chance to be part of the sample (Khan et al., 2022c). The probability sampling technique has further types which include simple random sampling, stratified random sampling, cluster sampling and systematic sampling. On the other hand, non-probability sampling also contains several types, which include convenience sampling, snowball sampling, quota sampling and purposive sampling. In the current study, all respondent has an equal chance of participation in the research and the researcher also has not fixed the chances of selecting a sample size so non-probability sampling was used to take a sample. Moreover, non-probability sampling is further divided into four types; quota sampling, snowball, convenient, sampling and judgmental sampling. For sampling in the present study, convenient sampling was used for the sample.

3.2 Sample Size and Data Collection

The sample size stated the number of respondents participating in the data collection process by giving their responses (Agha et al., 2021; Rashid et al., 2021). It was also noted that the sample size should be measured as reliable and measured through authentic sources to get more accuracy in results (Hair et al., 2018). In the current study, the sample size was calculated using G*power software; it calculates sample size based on an appropriate statistical model and several predictors (Faul et al., 2009). The estimated sample size for this study was 129 respondents. The instrumentation used for data collection was a structured close-ended questionnaire that was developed by adapting constructs from existing studies. These constructs include artificial intelligence (AI), adaptive capability (AC),

Supply chain collaboration (SCC), supply chain resilience (SCR), and supply chain performance (SCP). The given below table 1 shows the constructs along with their sources.

Table 11: Instrumentation

Constructs	Adapted Items	Sources
AI	5	(Dubey et al., 2020)
AC	3	(Tarafdar & Qrunfleh, 2017)
SCC	3	(Dubey et al., 2020)
SCR	5	(Yu et al., 2019)
SCP	4	(Srinivasan & Swink, 2018)

4. Data Analysis

The statistical analysis applied in this study includes descriptive statistics to check the univariate normality, reliability analysis to test the internal consistency of data, and bivariate correlation analysis will be applied to examine the multicollinearity issue. The regression analysis will be used to test the proposed hypothesis (Haque et al., 2021). Descriptive statistics was ascertained for analyzing the normality of data. It consists of mean, standard deviation, skewness, and kurtosis. Hair et al. (2018) stated that to fulfil the univariate normality, skewness and kurtosis values should be in the range of $\pm$2.5. The given below Table 2 illustrates the descriptive statistics. The calculated outcomes presented in table 2 affirm that the construction supply chain performance (SCP) (Mean=3.53, S.D=0.78) has the maximum skewness (sk=0.936), while the construct Artificial intelligence (AI) (Mean=0.403, S.D=0.75) has the least skewness (sk= 0.403). Besides this, the construct Supply chain collaboration (SCC) (Mean=3.60, S.D=0.70) has the maximum kurtosis (k=1.271), whereas, the construct Artificial intelligence (AI) (Mean=0.403, S.D=0.75) has the least kurtosis (k=0.069). Since all these results are not the out of range (i.e. $\pm$2.5). Further, Hair et al. (2018) stated that there is a possibility of error in responses collected from respondents and the data collection process. The collected data should have internal consistency; it was examined by the application of reliability analysis. The value of reliability should be at least 0.70 or greater. The results presented in above table 2 illustrate that the construct maximum reliability value (Alpha = 0.784) is for measurement scale Adaptive capability (AC) (Mean =3.60, S.D=0.72) whereas the least reliability (Alpha =0.725) is for construct Supply chain resilience (SCR) (Mean=3.54, S.D=0.74). Since these outcomes illustrate that all measurement scales have at least 0.70 reliability all adapted constructs used in this study are reliable for this study.

Table 2: Descriptive statistics

Construct	Mean	Std. Dev.	Skewness	Kurtosis	Standardized Cronbach's Alpha s
AC	3.60	0.72	-.464	.364	.784
SCC	3.60	0.70	-.773	1.271	.759
SCR	3.54	0.74	-.738	.217	.725
SCP	3.53	0.78	-.936	1.233	.764

Correlation analysis emphasizes the strength of association among each pair of a variable. According to Hashmi et al. (2021a), the minimum correlation among each pair of a variable should not be less than $\pm$0.30 and the maximum correlation among each pair of the variable should not be absolute. According to the calculated outcomes presented in given above table 3 shows that the strongest relationship (r=0.562) is between supply chain performance (SCP) and supply chain resilience (SCR), while the weakest association (r=0.303) is among supply chain performance (SCP) and adaptive capability (AC). Since these values illustrate that the association among each pair of constructs is not below $\pm$0.30 and also not absolute, these outcomes affirm that the constructs used for the present study have less chance of multicollinearity issue (Hashmi et al., 2021a).

Table 3: Bivariate correlation

Construct	AI	AC	SCC	SCR	SCP
AI	1				
AC	.436**	1			
SCC	.436**	.408**	1		
SCR	.535**	.353**	.514**	1	
SCP	.447**	.303**	.360**	.562**	1

** Correlation is significant at the 0.01 level (2-tailed).

4.1 Convergent Validity

The construct validity was tested by the application of convergent and discriminant validity. Convergent validity was applied to examine the inter-item relationship and the acceptability criteria for convergent validity include composite reliability (Hair et al., 2018), which should not be less than 0.70 and the loading factor should not be less than 0.40. Further, the AVE for each construct should not be less than 0.50 (Fornell & Larcker, 1981). The results in table 4 indicate that the factor loading of all items is not less than 0.40, and composite reliability (CR) for adaptive capability, artificial intelligence, supply chain collaboration, supply chain performance and supply chain resilience is not less than 0.70. Furthermore, the Ave for all constructs is also not less than 0.50. So the convergent validity was established for all constructs. The summarized outcomes for the mentioned criteria are illustrated in table 4.

Table 4: Convergent validity

Construct	Items	Factor Loading	AVE	CR
Adaptive capability	AC1	0.770	0.563	0.795
	AC2	0.746		
	AC3	0.736		
Artificial intelligence	AI1	0.639	0.512	0.839
	AI2	0.687		
	AI3	0.776		
	AI4	0.761		
	AI5	0.705		
Supply chain collaboration	SCC1	0.700	0.542	0.779
	SCC2	0.709		
	SCC3	0.794		
Supply chain performance	SCP1	0.760	0.582	0.848
	SCP2	0.777		
	SCP3	0.717		
	SCP4	0.796		
Supply chain resilience	SCR2	0.727	0.544	0.826
	SCR3	0.822		
	SCR4	0.720		
	SCR5	0.672		

4.2 Discriminant Validity

The discriminate validity was ascertained to test the discrimination in all constructs used in this study. It was examined through the method given by (Fornell & Larcker, 1981). According to this method, the square root of AVE should not be less than the correlation among each pair of variables. The given mention above table 5 illustrates the discriminant validity in which the square root of AVE is presented in the diagonal. The outcomes show that the square root AVEs for AC, AI, SCC, SCP and SCR is higher than the correlation value of each pair of a construct. Thus the acceptable criteria for discriminant validity have been fulfilled.

Table 5: Discriminant validity

Construct	T_AC	T_AI	T_SCC	T_SCP	T_SCR
AC	0.751				
AI	0.445	0.715			
SCC	0.406	0.443	0.736		
SCP	0.307	0.468	0.366	0.763	
SCR	0.331	0.545	0.487	0.545	0.737

Moreover, the Heterotrait-monotrait ratio of correlation (HTMT) was also applied to analyze the discriminant validity of the construct. The results are presented in table 6, this method is the updated approach of Fornell & Larcker (1981) in PLS-SEM to examine the discriminant validity of the construct. The acceptance criteria stated that the value of HTMT among each pair of constructs should be less than 1.00 and not greater than 0.90 and also lower than 0.85. Thus, the outcomes presented in the given below matrix show that all HTMT values are not greater than one so it fulfilled the discriminant validity standard.

Table 6: HTMT ratio

Construct	AC	AI	SCC	SCP	SCR
AC					
AI	0.638				
SCC	0.690	0.658			
SCP	0.443	0.587	0.542		
SCR	0.501	0.706	0.750	0.721	

4.3 Testing Overall Model

The proposed tested model has three independent variables which are adaptive capability (AC), artificial intelligence (AI), and supply chain collaboration (SCC), and one dependent variable is supply chain performance (SCP). Whereas there is one mediating variable which is supply chain resilience (SCR). The output of the estimated path model is presented in given below Figure 1. Structural equational modeling (SEM) was applied to test the proposed hypothesis of this study. The results of SEM were based on the Beta, p-values of the hypothesis path and confidence interval (LL and LU) (Hair et al., 2018). The confidence interval (CI) illustrates the values of the upper level (UL) and lower level (LL) but it is required that the value should not overlap to zero among each level (Hashmi et al., 2021). Whereas, before moving forward to overall model testing it should be confirmed that all the adapted constructs have no issue with multicollinearity. Hair et al., (2018) state that if the correlation among each pair of variables is not less than 0.30 and not greater than 0.90 then it can be safely assumed that variables have no issue with multicollinearity. Thus, it was carefully assumed that the path coefficient analysis and hypothesis testing can proceed. Bootstrapping with 500 resamples was applied to test the hypothesis. The results presented in table 7 illustrates that all the direct hypotheses have been accepted, excepted the hypothesis H3 and H6. Meanwhile, the bootstrapping with 500 resamples was applied to test the hypothesis for indirect effect among dependent and independent variables. The calculated results presented in table 7. The results show that all the mediators significantly mediates the relationship between exogenous variables and the endogenous variables as there is no zero straddling in between the LL and UL of the variables. Moreover, the sequential mediation is occurring between the tested variables.

Table 7: Results of the structural model

Structural Path	Beta	T statistics	*P*	LL	UL
H1: AI -> SCP	0.223	2.454	0.014	0.043	0.395
H2: AI -> SCR	0.399	5.903	0.000	0.261	0.528
H3: AC -> SCR	0.033	0.460	0.646	-0.106	0.180
H4: AC -> SCC	0.406	6.473	0.000	0.284	0.531
H5: SCC -> SCR	0.296	4.475	0.000	0.166	0.430
H6: SCC -> SCP	0.081	0.975	0.330	-0.075	0.253
H7: SCR -> SCP	0.384	4.314	0.000	0.207	0.553
H8: AI→AC→SCC	0.181	4.238	0.000	0.110	0.278
H9: AI→SCR→SCP	0.194	4.494	0.000	0.119	0.288
H10: AC→SCC→SCR	0.092	1.935	0.053	0.008	0.194
H11: SCC→SCR→SCP	0.120	3.262	0.001	0.059	0.203
H12:AI →AC→SCR→SCP	0.068	1.992	0.046	0.008	0.144
H13: AI→AC→SCC→SCR→SCP	0.114	3.291	0.001	0.053	0.186

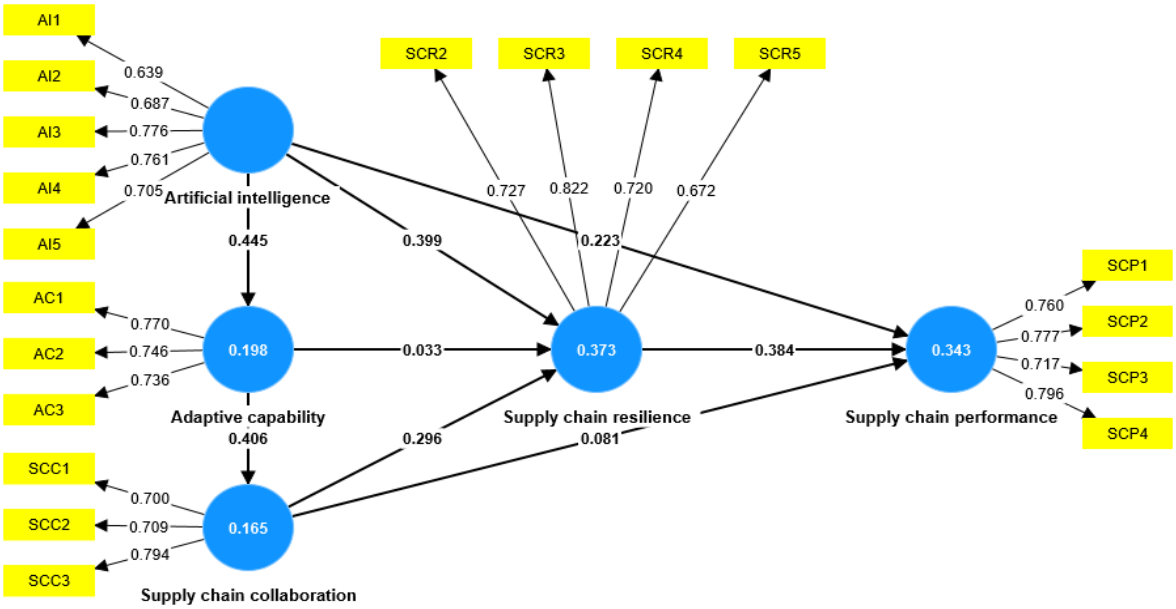

Figure 1: SEM path diagram

5. Conclusion and Discussion

This particular research study aims to investigate the factors affecting supply chain resilience to enhance supply chain performance through the mediation of supply chain resilience. This particular research was conducted according to the perspective of the manufacturing industry located in Karachi, Pakistan. This particular research was mainly based on the existing theory of Supply chain resilience. In the current research study, the influence of certain factors which include artificial intelligence, adaptive capabilities, and supply chain collaboration was investigated on SC Resilience. Also, the research model shows the influence of supply chain resilience on the overall performance of SC. To perform this particular research, a quantitative method of research was applied. The process of data collection was performed by using the questionnaire technique. As it was not possible to collect data from every member of the targeted population thus a sample of data was calculated by using G*power software and obtained a sample size of 129 respondents. To obtain more accurate results the developed questionnaire was distributed to the target population and a total of 206 responses were collected. The obtained data were analyzed by using structural equational modeling through using smart PLS4 software which the results of overall research were obtained. After analyzing data, it was observed that all the proposed hypothesis has positive and significant outcomes except hypothesis two and hypothesis six. It was concluded that the supply chains' artificial intelligence, adaptive capability and supply chain collaboration have a positive and significant influence on supply chain resilience and supply chain

performance, while supply chain resilience also has a positive influence on supply chain performance. Thus, the organizational, as well as the supply chain performance, can be enhanced by adopting supply chain resilience and other organizational dynamic capacities.

All the proposed hypothesis was consistent with existing studies as all the hypothesis were retained except hypothesis H2 and hypothesis H6. The research hypothesis "Artificial intelligence positively associated with supply chain resilience" was retained and answered to research question one: Does artificial intelligence has a relationship with supply chain resilience? Was match with existing literature? For instance, tools that are based on artificial intelligence provide supreme accountability in the supply chain. As, AI assists them in fast growth as they can improve or enhance the efficiency of engineering, prohibit faults, can shorten the phases of development and also increase safety by determining risky activities automatically, fall in the cost of inventory due to the effective planning of supply and demand, it also increases the revenue with the great rate sales which directs to the optimization of price and also to the determination and so on. The research hypothesis "Artificial intelligence positively associated with supply chain performance" was retained and answered to research question two: Does artificial intelligence has a relationship with supply chain performance? was matched with existing literature. According to the prospect of organization information processing theory (OIPT), we suggest that the implementation of artificial intelligence (AI) allows the supply chain to develop capabilities that are related to the processing of information (Srinivasan & Swink, 2018). It permits them to interpret and allows them to acquire knowledge from complex info that is collected from several sources to reduce the chances of uncertainties in demands, availability of supply and capacities (Grover et al., 2020). Else, firms are forced to contain a great level of inventories or depend on human capabilities that are limited to compose a reactive supply chain that as result affects the profitability of the firm and speed of implementation (Dubey et al., 2020). Overall, such conceptions and evidence of the adoption of artificial intelligence can be considered as the tool that effectively improves the performance of the supply chain.

The research hypothesis "Artificial intelligence positively associated with adaptive capabilities" was retained and answered to research question three: Does artificial intelligence has a relationship with adaptive capabilities? Was matched with existing literature. For instance, Earlier research studies clarify that the application of artificial intelligence constitutes a well-organized way of regenerating the element of additivity through learning and understanding the external atmosphere in that way they form a complex system more systemized, adaptive, flexible and reconfigurable at a higher level. Moreover, the technique of artificial intelligence is a facilitating way that supports adaptive systems' new generations of advancement. The research hypothesis "adaptive capabilities positively associated with supply chain collaboration" was retained and answered to research question five: Does adaptive capabilities has a relationship with supply chain collaboration? Was matched with existing literature. For instance, the literature of earlier studies highlights the adaptive capabilities and collaboration of SC to be the most influential elements that are required to build supply chain resilience (Scholten et al., 2019; Jain et al., 2017). For that reason, in this research study, adaptive capacity and SC collaboration are used as a factor that enables SC resilience driven by the capabilities of artificial intelligence.

The research hypothesis "supply chain collaboration positively associated with supply chain resilience" was retained and answer to a research question six: Does supply chain collaboration has a relationship with supply chain resilience? was matched with existing literature. For instance, in addressing the occasion or events of disturbance and disruption the element of resilience in the supply chain system cannot be accomplished until & unless firms collaborate in a very vibrant and synergetic way to respond effectively. This particular statement highlights the importance of collaboration which is very essential for achieving resilience in the supply chain. The research hypothesis "supply chain resilience positively associated with supply chain performance" was retained and answered to research question eight: Does supply chain resilience has a relationship with supply chain performance? Was matched with existing literature. For instance, Through resilience, the organization also receive an element of customer satisfaction that they considered important performance outcomes (Govindan et al., 2015). Moreover, resilience in the supply chain system of a firm acts as a capability and

competitiveness that enables the firm to recover from the situation after a disruptive situation (Gligor et al., 2019). Thus, in various previous research studies, it is claimed that the concept of resilience in the supply chain plays a huge role in increasing supply chain performance (Gölgeci & Kuivalainen, 2020).

5.1 Research Implications

This particular research study provides insight to the practitioners and managers of manufacturing firms for improving their level of resilience in the supply chain. The concept of supply chain resilience receives a high level of attention and became famous among managers of the firm because the concept of a resilient supply chain increases the capability and feasibility of SC. Resilience in the supply chain also enables the SC partners to achieve their goals and also increase their competitiveness and benefits. The most essential practical implication of this research is that it will help in emerging strong resources and trajectory views for managing strategies are the main factors of resilient SC. Through this, associated parties can widely concentrate on those practices that may increase the supply chain performance of an organization.

This particular research study plays a significant role in literature by highlighting the concept of supply chain resilience & supply chain performance of organizations. Particularly this research study associates the factors affecting supply chain resilience which include artificial intelligence, adaptive capability and supply chain collaboration. The theoretical context of the model can be used in other forms of inter-organizational relationships including resilience in the supply chain. Moreover, it also extends the knowledge of factors affecting supply chain resilience by incorporating artificial intelligence, adaptive capability and supply chain collaboration as independent variables for supply chain resilience. However, the supply chain performance can be enhanced through the enhancement of a supply chain resilience system.

5.2 Limitations and Recommendations

There are a few important limitations and recommendations that are important and considerable to discuss specifically for this research study. This particular research study suffers from various limitations. To conduct this study, the required literature review was not as available or limited to confirm the validity of content scales. The current research study mainly concentrates on finding the influence of include artificial intelligence, adaptive capability and supply chain collaboration, further research studies would clarify the differences in different target segments by considering other variables i.e. operating frontier, trajectory and absorptive capacity. To obtain meaningful outcomes it is important to use a large sample size. To validate the content in an improved way future research must extend the validation of content by combining to get validation of content. Further future research on this topic can find out whether alternative variables influence the linkages that exist between artificial intelligence, adaptive capability and supply chain collaboration and proactive and reactive dimensions SC resilience. It is essential and recommended for future research to have an extended sample size.

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