South Asian Management Review
2022 Vol. 1, No. 2, 51-65
Article: SAMR-2212

Impact of Lean Manufacturing on Organizational Performance through a Moderating Role of ERP

Gulrez Saleem[1*]

[*1] *Researcher, Department of Business Administration, Iqra University, Karachi, Pakistan*

**Corresponding email: gulrezkk@gmail.com*

Article History

Received: 06 September 2022
Revised: 27 September 2022
Accepted: 01 October 2022
Published: 05 October 2022

JEL Classification
R41
L60
N70

ABSTRACT

Lean manufacturing is regarded as a rewarding production approach because of its sound effects on organizational and economic efficiency in various sectors. Given the increased environmental consciousness, the environmental successes of lean manufacturing also have significant economic importance. According to some experts, lean manufacturing is a business technique utilized to enhance an organization's process performance. This is because it leads to an increase in both the bottom-line outcomes and customer satisfaction. As a result, many studies have demonstrated that lean manufacturing significantly influences an organization's operational effectiveness. Furthermore, introducing an ERP system brought several benefits in meeting the changing expectations of consumers by delivering accurate and timely information about customers to the company so that they could make adjustments in their choice, respecting the customers' demands. Furthermore, in this study, the researcher discovered the influence of lean manufacturing on organizational performance in connection to the mediating function of ERP. Furthermore, the researcher examined all of the lean manufacturing methods that were interconnected.

Keywords: *JIT, Purchasing, Production, Total quality management, Total production management, Operational performance, Financial performance*

Citation of this article:

Saleem, G. (2022). Impact of lean manufacturing on organizational performance through a moderating role of ERP. *South Asian Management Review, 1*(2), 51–65.

Impact of Lean Manufacturing on Organizational Performance through a Moderating Role of ERP

1. Introduction

Manufacturers all across the globe are adopting new tools and practices to enhance their manufacturing processes due to the advent of technological developments, competitive pressure, ever-increasing globalization and an uncertain environment. Manufacturers are more focused on enhancing their manufacturing processes because improved manufacturing within industries leads to better supply chains, operations, and overall enhanced industry performance. Several manufacturers have adopted practices of lean manufacturing like JIT (just-in-time), TQM (total quality management) and TPM (total productive maintenance). These practices are helping its users enhance the quality of products and the organization's productivity. According to the study conducted by Yusuf and Adeleye et al. (2002), it is revealed that these tools and practices of lean manufacturing are essential. However, they cannot be effective and efficient enough if implemented in a complex and uncertain environment. Many organizations have integrated the technique of agile manufacturing to identify the effect of lean manufacturing practices on the organization's overall performance. Numerous scholars and researchers have depicted the significant impact of the integration of lean manufacturing on the environmental, social, as well as the financial performance of an organization (Baloch & Rashid, 2022).

According to the study executed by Yang et al. (2011), it is found that lean manufacturing is the methodology which is formed for reducing the production cost of the company, which implements it through curtailing waste production. On the other hand, the study conducted by Bellisario and Pavlov (2017) states that lean manufacturing is considered the strategy of conducting business which intends to perk up the functioning of production processes of an organization while considering the significant improvement in the bottom line results and level of customer satisfaction. Hence, different studies have shown different definitions of lean manufacturing. However, all the definitions portray the significant influence of lean manufacturing practices on the operational performance of the firm which implements them. At present, every business organization is focused on improving its performance through the deployment of information systems because of ever-increasing competition in the business environment globally. The integration of information systems assists businesses by decreasing the cost of production, reducing the time cycle and improving customer services. In addition to lean manufacturing, businesses are integrating ERP systems into their business functions to meet their customers' varying needs and expectations by providing timely and accurate information. This is assisting businesses in gaining a high level of customer satisfaction towards their services or products. ERP systems are helping businesses in changing their business-related decisions according to the expectations of their customers (Shaheen, 2022; Alam, 2022).

Many studies have focused on the deployment of the tools and practices of lean manufacturing and their impact on the overall organization’s productivity and performance. For instance, the study of Bellisario and Pavlov (2017) states that significant improvement has been observed in the operational performances of the organizations which integrated lean manufacturing tools and practices through attaining better employee engagement in the business operations and decisions. On the other hand, the study of Yang et al. (2011) depicts the positive impact of environmental management and lean manufacturing on the performance of an organization. According to this study, there is a positive linkage between environmental management practices and lean manufacturing, which ultimately results in the improved performance of an organization (Asif, 2022; Uddin, 2022).

According to another study conducted by Iranmanesh et al. (2019), lean manufacturing practices substantially ensure an organization's sustainable performance. The study has further elaborated that the organization that embraces lean culture bestows sustainable organizational

performance by moderating supplier relationships' impact. Another study by Belekoukias et al. (2014) states that how lean manufacturing practices are implemented in the organization also significantly controls organizational performance. Furthermore, the study has highlighted that there is less impact of just-in-time, i.e. JIT, lean manufacturing practice, on the performance of an organization compared to that of total productive maintenance, i.e. TPM and total quality management, i.e., TQM. Another study conducted by Khalfallah et al. (2020) has declared the influence of lean manufacturing practices on the financial and operational performance of the organization. This study has used the mediating role of agile manufacturing practices to determine the impact of lean manufacturing practices on overall organizational performance. The studies carried out by Fullerton et al. (2009), and Taj et al. (2011) depict that lean manufacturing practices significantly influence organizational financial performance. However, it does not impact the organization's operational performance.

The study has further highlighted how ERP plays a mediating role in explaining how practices of lean manufacturing affect organizational performance, as the study of Hassabelnaby et al. (2011) has declared that the deployment of ERP influences organizational performance. The previously conducted research work has determined the impact of lean manufacturing on the overall organizational performance, and it did not consider ERP as a mediator. On the other hand, the study conducted by Rashid et al. (2022) claims that the performance of an organization has been improved through the deployment of technology in its business functions. Although much research has been done to determine the association between organizational performance and lean manufacturing, the role of ERP as a mediator in forming a positive relationship between the two is still uncertain. Some researchers have only focused on business performance, whereas others have focused only on operational performance or an organization. Therefore, to fill the gap in previous studies, this study aims to determine the influence of lean manufacturing on an organization's organizational and operational level performance. Furthermore, this study will further observe the moderating impact of ERP on organizational performance and lean manufacturing practices (Ayaz, 2022; Anwar, 2022).

1.1. Research Questions

There are some research questions related to this study given as follows:

RQ1: To what extent does lean manufacturing influence organizational performance?

RQ2: To what extent does ERP moderate the relationship between lean manufacturing and organizational performance?

2. Literature Review

2.1. Lean Manufacturing and Performance

The research work carried out by Khalfallah et al. (2020) has evaluated the mediating impact of agile manufacturing on an organization's organizational performance and lean manufacturing. The link between the performance of an organization and its lean manufacturing practices while considering the factors of TQM, TPM, JIT production and JIT purchasing will be determined in this study. Around 205 manufacturing organizations have been selected from Tunisian, and SEM is used to examine the collected data of the study. This study has found that lean manufacturing practices are positively and directly linked with agile manufacturing. In addition, the study revealed the highly positive impact of agile manufacturing on organizational performance. This study has further found that lean manufacturing practices do not significantly impact the organization's operational performance. Moreover, this study highlighted that the linkage between organizational performance and lean manufacturing practices was mediated by agile manufacturing. Hence, this study has emphasized the significance of agile manufacturing practices for improving an organization's operational performance (Amjad, 2022; Hunaid et al., 2022).

There is one more study which was conducted by Bellisario et al. (2017) revealed how

organizations make use of performance management practices while implementing lean manufacturing in order to enhance their organizational performance. The impact of these practices on organizational performance has been determined in the study. This study chose the method of systematic review to discover the relationship between organizational performance and lean manufacturing practices between the period of 2004 to 2015. This study has further explored the significant role of performance management in lean manufacturing practices, consequently improving the organization's financial performance. However, this study revealed some issues while carrying toward the operational performance and lean manufacturing practices, so it is recommended that businesses must deploy strategic performance practices while integrating performance management and lean manufacturing practices (Rashid & Amirah, 2017).

Another study by Yang et al. (2011) examined the impact of environmental management and lean manufacturing practices on organizational performance. Hence, this study aimed to determine the association between environmental performance and lean manufacturing practices and business performance outcomes. This study gathered data from around 309 international manufacturing organizations and used the technique of AMOS to analyze the data and verify the research's proposed hypothesis. This study further found that there is a highly positive relationship between environmental practices and lean manufacturing practices of an organization. It is further explored that there is a negative effect of the practices of environmental management on the operational as well as the financial performance of the organization. The study revealed that better environmental performance practices could lead to an improved financial performance by diminishing the negative impact of environmental practices on an organization. Therefore, the study suggested deploying effective environmental management practices, which should be evaluated sporadically to attain improved organizational performance outcomes (Rasheed, 2022; Victory et al., 2022).

Another study conducted by Iranmanesh et al. (2019) has discovered the influence of lean manufacturing practices on overall organizational performance. The moderator selected for conducting this study was the lean culture which helped evaluate the relationship between the organizational performance and lean manufacturing practices of an organization. This research work revealed that non-government organizations, governments, and customers impose high pressure on manufacturing firms to carry out their production processes sustainably. It is further found that the deployment of lean practices within the manufacturing firms has played a significant role in benefiting the organization in terms of environmental, social as well as economic context as it ultimately assists in attaining sustainable performance within the organization. This study explored the effect of lean manufacturing practices on an organization's environmental performance, gathered data from around 187 manufacturing firms in Malaysia, and used the PLS method to analyze the collected data. This research work has found a significant positive impact of the supplier relationship, equipment and process, product design and customer relationship on an organization's sustainable performance. This study further found a moderating impact of supplier relationships and the equipment and processes in the presence of lean culture on the organization's sustainable performance (Ali, 2022).

2.1.1. JIT and performance

The research work of Bashar et al. (2019) determined the impact of JIT production on overall organizational performance. The area of apparel manufacturing was selected in this study as the manufacturers of apparel confront tremendous pressure to improve the performance of their manufacturing processes to attain a high competitive advantage within the marketplace. The study found that manufacturers are required to involve themselves in the implementation of advanced as well as new manufacturing methods in order to make their manufacturing processes even more effective and productive. Integration of innovative and advanced manufacturing methods within developing countries appears to be highly challenging because of several barriers or obstacles. This study focused on the integration of JIT production and measured its influence on both the operational as well as the financial performance of an organization. Around 227 manufacturers of apparel were chosen from Bangladesh to gather data for this study through the deployment of a convenient

sampling approach. Afterwards, AMOS and SPSS software was chosen to analyze the gathered data for this study to determine the impact of JIT production on organizational performance. This study found a direct and highly positive impact of the integration of JIT production on both the operational as well as the financial performance of an organization (Muzammil, 2022; Basit, 2022).

Another study by Danese et al. (2012) identified the relationship between JIT supply, organizational performance and JIT production. This study aimed to assess the impact of JIT practices, specifically the practice of JIT production, on organizational performance. The moderating impact of JIT production was measured in this study on the performance and efficiency of an organization. Six hypotheses were developed in this study to determine the relationship between efficiency, organizational performance, JIT production and JIT supply. Around 206 manufacturing firms were chosen to gather data for this research. The collected data was then analyzed with the help of regression analysis. Highly positive impact was identified of JIT production practices on the delivery as well as efficiency of the organization's products. Moderating impact of the practices of JIT supply was also observed on the relationship between JIT delivery and JIT production of the organization's products. On the other hand, no moderating impact of JIT supply on the performance efficiency of an organization was observed. Hence, the study revealed the two-fold role of JIT supply as a moderator. In contrast, JIT production influenced the overall organizational performance and production considerably.

Another study by Phan et al. (2019) measured the influence of JIT production and TQM on organizational performance. This study found the association between TQM, JIT production and organizational performance specifically for manufacturing companies. The sample size of 280 manufacturing firms was selected to gather data for this study. Furthermore, these manufacturing firms were selected from twelve different countries. Furthermore, this study used regression analysis and correlation methods to analyze the collected data for this study. This study found a significant and close relationship between JIT production, organizational performance and TQM. In addition, this study revealed the highly positive impact of JIT production on the flexibility of organizational performance. The study suggests that it can be further improved by deploying the practices of TQM. Hence, the study found that the organization's flexibility performance can be improved by integrating the JIT production and TQM. This is because it improves the impact of each other, which ultimately leads to better organizational flexibility performance.

2.1.2. Total quality management (TQM) and performance

The study by Valmohammadi et al. (2015) identified the relationship between organizational performance, TQM and organizational culture. This study was found to be circulating around the four main aims. The first objective of this research work was to determine the impact of TQM and culture on overall organizational performance. The study's second aim was to evaluate and assess the manufacturing organization's culture. The third aim of this study was to investigate the deployment of different types of TQM practices and their influence on manufacturing organizations. Lastly, this study compared the two models to define the relationship between the organizational culture, TQM implementation and organizational performance. Senior managers were asked to provide data for conducting this research, and around 209 manufacturing companies were chosen as the sample for this study. The study revealed that organizational culture is dominant in directing the organizational performance. The study further elaborated that the selected organizations efficiently integrated TQM practices, and these practices have had a highly positive influence on organizational performance. Therefore, it can be concluded that there is a significant and highly positive impact of TQM on financial, operational, and organizational performance. Hence, it can be said that this study determined the relationship between the practices of TQM, organizational performance and organizational culture. This relationship was measured on an individual basis to achieve the findings of the study.

The study conducted by Brah et al. (2006) found the impact of TQM and technology on the organizational performance of logistic companies. The study revealed that integrating technology and

TQM had gained more attention from business organizations to challenge market opponents and achieve their business goals. As businesses are increasingly using TQM and technology to remain competitive, competition in the business environment is continuously increasing in today's marketplace. Internal integration has been improved by the deployment of TQM of all logistic companies, and they benefit their companies through technology. The study found the relation between technology, organizational performance and the practices of TQM for logistics companies. This study revealed that there is a substantial effect of technology as well as TQM on organizational performance. Hence, it can be said that the deployment of both the TQM and technology plays a significant role in improving the performance of an organization. Therefore it suggests implementing high technology into the business operations of logistic companies.

2.1.3. Total productive maintenance (TPM) and performance

The study by Singh et al. (2015) explained the implementation of TPM and TQM and analyzed their impact on the overall organizational performance. This study's primary aim was to explore the impact of TQM and TPM on the organizational performance of manufacturing firms. This study further supported the research work in the area of TPM and TQM by measuring the synergetic impact of these practices on organizational performance. Large-sized manufacturing firms were chosen to conduct this study and found the benefits of deploying TPM and TQM in terms of improving the organizational performance of manufacturing firms. The performance of such approaches was compared in this study which assisted in finding a significant impact of the integration of TPM and TQM on the organizational performance of manufacturing companies. This study further elaborated that TPM implementation can help companies improve their core competencies and their power to tackle business challenges in today's competitive business environment. This study also developed an understanding of TPM and TQM initiatives for manufacturing firms. Furthermore, this study revealed the highly positive influence of TPM and TQM on manufacturing firms' financial and operational performance.

The study of Ahuja et al. (2008) evaluated the initiatives of TPM integrated by the industry of India to improve the organizational performance of their manufacturing firms. In doing so, this study explored the practices of TPM that the manufacturing firms of India have adopted to improve their organizational performance. Statistical tools were used in the study to determine the correlation between organizational performance and the integration of TPM. The outcomes of this study revealed that there is a significant contribution of the deployment of TPM to the improved organizational performance of manufacturing firms. Certain success factors like the involvement of top management, effective leadership, and a holistic way of implementing TPM practices can bring about upgraded functions and operations of manufacturing firms. This study further revealed there is a positive impact of these success factors on the organizational performance of manufacturing firms. Hence, it can be said that this study focused significantly on TPM and revealed the positive impact of TPM on organizational performance in the case of manufacturing firms.

The study by Bashar et al. (2020) has drawn the relationship between organizational performance, TPM and people management. The main aim of this study was to find the association between these three elements specifically for the apparel industry of Bangladesh. The study revealed mediation and a direct effect of TPM on overall organizational performance. Around 227 large and small-sized garment organizations were selected from the garment industry for this study. A casual linkage was found between organizational performance, people management and TPM and the approach of SEM was used to analyze the collected data. This study has further found that people management has an indirect and direct impact on organizational performance. On the other hand, this study revealed TPM's mediating and direct impact on the organization's operational performance. Figure 1 illustrates the research framework of this study.

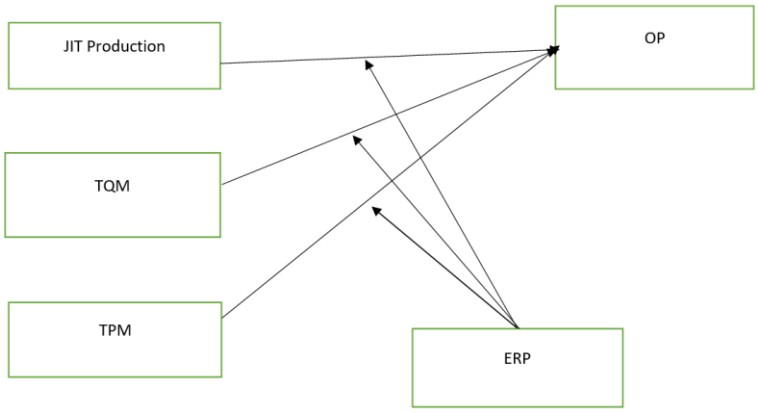

Figure 1: A research framework

2.2. Study Hypothesis

The hypothesis of this study is given as follows:

H1: JIT has a significant impact on organizational performance.

H2: TQM has a significant impact on organizational performance.

H3: TPM has a significant impact on organizational performance.

H4: ERP significantly moderates the relationship between JIT and organizational performance.

H5: ERP significantly moderates the relationship between TQM and organizational performance.

H6: ERP significantly moderates the relationship between TPM and organizational performance.

3. Research Methodology

The plan which is to be followed for conducting research is explained in the research approach, and it considers the broad assumptions used to carry out the collection of research data. Explanatory research and exploratory research are the two major types of research approaches which are used for explaining data analysis as well as data collection methods. Researchers use exploratory research when they need to gather more information related to the topic, which is vague (Alase, 2013; Rashid et al., 2021; Hashmi &Mohd, 2020). Hence, researchers use this approach when they are involved in investigating topic-related issues. On the other hand, researchers use explanatory research to enhance the understanding of the previously conducted research topic. Hence, this approach predicts future consequences and provides further details about the study. Therefore, the researcher in this study selected an explanatory research design to understand other lean manufacturing practices and their impact on organizational performance (Hashmi et al., 2020a, b).

3.1. Research Design

This is considered the strategy that explains the logical working of all the study components to ensure that the research problems have been addressed and the research objectives have been achieved. The four main types of research designs are descriptive, correlational, experimental, and causal research designs. When the relationship between independent and dependent variables is

determined, researchers use a correlational research design. The strength of each variable is explained in this research design. Researchers use descriptive research design when the information related to the topic is to be collected, or the phenomena or topic needs to be explained. In addition, a simple research design is deployed when the cause-effect relationship between the research variables needs to be identified. Therefore, this study needs to determine the relationship between research variables, so a correlational research design has been chosen (Hashmi et al., 2021a, b).

3.2. Sampling

The method used for collecting samples from the specified population is termed sampling (Rashid, 2016). The data is gathered from the population to research the collected data. Manufacturing organizations are the target population for this study to determine the practices of lean manufacturing being implemented by manufacturing organizations and the impacts they are observing on the organizational performance due to implementing lean manufacturing practices. The way in which data for the study is collected using a sampling technique. Non-probability and probability sampling are the two effective sampling techniques (Apuke, 2017; Rashid et al., 2019). In this study, the sample is selected randomly for collecting research data (Rashid et al., 2020). Ensuring a sufficient amount of participants for sharing their thoughts, ideas, information or thoughts related to the research topic is the primary purpose of setting the sample size for the study. The sample size incorporates a large population with the same behavioural pattern, employment background, interests, educational background or demographic characteristics. This study has selected a sample size of 177.

3.3. Instruments of Data Collection

The collection of data plays a significant role in conducting any research as the entire findings of the research rely on the data that has been collected from the participants of the research. Therefore, selecting the best suitable instrument for data collection is crucial as it will help gather appropriate data in the given time frame. There are different types of instruments used for data collection, such as questionnaires, interviews, surveys, case studies, observations and experiments. The validity and reliability of the selected research instrument are essential. This reliability and validity depend directly on the appropriateness and validity of the research findings. Hence, this study has opted for a survey questionnaire as a research instrument for collecting data for the study.

3.4. Procedure of Data Collection

This is also very important in how data is collected for conducting research. This study intends to circulate the survey questionnaire to the research participants, i.e. manufacturing organizations and the upper management and senior management will attempt the given survey questionnaire and return it to the researcher. The variables used in this research have also been highlighted in the questionnaire so that the participants quickly get to know how the influence of lean manufacturing practices on organizational performance is being measured through this research.

4. Data Analysis

The result confirmed that each response was valid as Cronbach alpha reported above 0.7. The construct validity is significant at the level of measured items taken from a sample of respondents. Literature shows that the results of outer loading should be more than 0.7 (Fornell & Larcker, 1981; Rashid & Rasheed, 2022). The results of factor loading showed that loaded items were significant based on their construct and higher than other constructs. This also explained that Cronbach's alpha should be more than 0.7 for the reliability of all items (Rashid et al., 2022). Table 1 shows the measurement model results based on factor loadings, CR and AVE, also known as construct reliability.

Table 1: Measurement model

Variables	Items	Loadings	CR	AVE

ERP	ERP1	0.769	0.842	0.667
	ERP2	0.874		
	ERP3	0.858		
	ERP4	0.759		
JIT	JIT1	0.878	0.969	0.727
	JIT2	0.793		
	JIT3	0.793		
	JIT4	0.937		
OP	OP1	0.877	0.788	0.564
	OP2	0.881		
	OP3	0.728		
	OP4	0.725		
TPM	TPM1	0.794	0.727	0.521
	TPM2	0.709		
	TPM3	0.87		
	TPM4	0.76		
TQM	TQM1	0.841	0.772	0.573
	TQM2	0.744		
	TQM3	0.715		
	TQM4	0.721		

Table 1 has been based on the different recommended thresholds as factor loadings can be accepted when the values are higher than 0.70 (Hashmi et al., 2021b). On the other hand, when the values are not accepted on this, it is recommended that it can also be accepted when the values are higher than 0.40. Moreover, the CR can only be accepted when the values are higher than 0.70 and AVE when the values are higher than 0.50(Hashmi et al., 2021a). Hence, the table has been based on these recommendations, and therefore, the measurement model has been achieved.

4.2 Discriminant Validity

Table 2 illustrates the Fornell and Larcker (1981) discriminant validity criterion. The results are based on the recommendation that diagonal values should be higher in their construct, both horizontally and vertically. Table 2 shows all correct values, and therefore discriminant validity was achieved using Fornell and Larcker's (1981) criterion. The above is based on the recommendation that all bold values should be higher in their construct when compared with other values (Rashid & Rasheed, 2022).

Table 2: Fornell-Larcker criterion

	ERP	JIT	OP	TPM	TQM
ERP	0.816				
JIT	0.693	0.852			
OP	0.741	0.156	0.751		
TPM	0.636	0.168	0.592	0.721	
TQM	0.723	0.003	0.73	0.71	0.757

The *p* value should be less than 0.05 for the significance of the hypothesis. As from table 3 we can see that the P value for each hypothesis except H4 (ERP significantly moderates the relationship between JIT and organizational performance) is less than 0.05. This means JIT, TPM and TQM have significant effect on organizational performance and ERP significantly moderates the relationship between TPM and organizational performance as well as TQM and organizational performance. The ERP does not significantly moderate the relationship of JIT and organizational performance. Therefore, it can be concluded that Hypothesis 1, Hypothesis 2, Hypothesis 3, Hypothesis 5 and Hypothesis 6 are supported; while Hypothesis 4 is rejected.

Table 3: A path analysis

	Standard deviation	T statistics	P values
JIT -> OP	0.055	2.231	0.026
TPM -> OP	0.096	2.115	0.045
TQM -> OP	0.103	3.986	0
ERP x JIT -> OP	0.048	0.801	0.423
ERP x TPM -> OP	0.071	2.4	0.016
ERP x TQM -> OP	0.072	2.369	0.017

5. Conclusion

Lean manufacturing, also known as Lean Production, is a manufacturing approach that has been widely adopted as a successful strategy by businesses of all sizes and in a wide range of industries throughout the world. Using tools like Total Quality Management (TQM), Just-in-Time (JIT), etc., lean manufacturing focuses on reducing or eliminating non-value-added steps and various forms of waste (MUDA) throughout the production process (JIT). In today's market, when businesses are facing fierce price rivalry in response to shifting consumer expectations, the ability to create the same volume of products at lower prices is more important than ever. Nonetheless, Khalfallah et al. (2020) research suggests LMP have little or no impact on business success. On the other side, lean manufacturing's positive impact on the environment may result in monetary rewards via acquiring new customers, competitive differentiation, and cost savings achieved via waste reduction. Additionally, lean manufacturing helps with bottom-line results because it reduces the administrative cost of reducing pollution by either educating business leaders on the need and value of pollution reduction or by decreasing the expense associated with enacting environmental improvement. These findings demonstrate the beneficial correlation between lean manufacturing and overall business success.

TQM, JIT, and TPM aim to boost organizational performance via continuous development and waste removal. The three methodologies of Total Quality Management, Just-in-Time, and Total Productive Maintenance all work together to provide a unified and systematic approach to manufacturing focused on excellence. Because of this, TQM, JIT, and TPM will likely be applied together in manufacturing facilities. However, most TQM, JIT, and TPM research focuses on each methodology independently. Nevertheless, research into the connections between TQM and JIT has been limited. Some studies consider all three programs, although indirectly concentrating on only one. TPM's connection to Just-In-Time and Total Quality Management pertains to its use and effect on business. Low costs, good quality, and reliable delivery performance are all positively related to TPM directly and indirectly through JIT. On the contrary, many academics challenge the need to study the interplay between several production software packages. For example, maintenance management may be the most challenging aspect of implementing TQM, JIT, or computer-aided production. There is a need to consider how to involve workers in implementing JIT, TPM, quality control, and industrial automation. TQM and TPM constitute the backbone of the JIT manufacturing system.

There are several ways in which ERP serves as a moderating influence on lean manufacturing processes and the efficiency of a firm. Furthermore, reducing transportation waste while transferring goods and resources to a new place, such as a staging area, warehouse racks, or shipping ports. Money is spent on equipment, labour, and time on these tasks. Because of the lack of benefit to either the producer or the consumer, this is a money-losing endeavour. ERP also helps lean manufacturing by providing tools for more innovative production methods and more effective logistics. Plus, there is less of a wait. This may occur because of factors such as a lack of coordination between production staff members or the inability to access crucial information. By centralizing all relevant data in one place, ERP boosts lean manufacturing in this scenario. It aids in locating bottlenecks, making better-informed scheduling and planning decisions, and facilitating the implementation of mission-critical initiatives. Moreover, overproduction is a root cause of every other type of waste in lean production. This occurs when businesses create more of a particular item than is needed by customers or when supplies are manufactured in advance of demand. Overproduction may be avoided and even cured

with better supply chain management, purchasing, and demand planning. Thankfully, ERP enhances lean manufacturing by providing purpose-built tools for improved supply chain management, automating the procurement process, and correctly estimating demand based on historical data and market trends.

5.1. Discussion

H1: JIT has a significant impact on organizational performance.

The hypothesis demonstrates that JIT improves organizational performance. Furthermore, the author discovered that implementing JIT by numerous organizations' owners and shareholders is expected to result in cost reductions, increased efficiency, and higher profit levels. Their key goal in implementing JIT is to retain or strengthen the company′s competitive edge in the marketplace. Furthermore, Bashar et al. (2019) found that implementing JIT manufacturing significantly benefits and directly influences an organization's performance. While the study of Phan et al. (2019) emphasized that using both TQM and JIT production techniques enhances an organization's flexibility performance because both improve the influence of each other to boost an organization's flexibility performance. Furthermore, the results of this study show that the p values are 0.026. Hence, JIT has a significant impact on organizational performance.

H2: TQM has a significant impact on organizational performance.

Based on the findings of this study, the concept that TQM has a favourable influence on an organization's financial presentation is maintained. Furthermore, the author explored that it boosts market share and saves costs through effective product design, resulting in increased revenues for the firm. TQM would also enhance operations by optimizing resource consumption and decreasing waste. Moreover, the results of this research study show that the p values are 0.000. Hence, TQM has a significant impact on organizational performance. Furthermore, Brah et al. (2006) said that TQM and technology significantly influence an organization's overall performance and that TQM has an incredibly significant result on performance when compared to the introduction of lower-level technology.

H3: TPM has a significant impact on organizational performance.

The hypothesis indicates that the TPM exerts a decent influence on the financial performance of a business. Further, the researcher identified that TPM might have quantifiable, enduring outcomes such as higher quality output, enhanced factory maintenance regime, decreased turnover and a proactive culture that 'Takes Pride in its Machinery'. Additionally, Singh et al. (2015) suggest that TQM and TPM confer significantly favourable influence on the operational as well as the financial performance of manufacturing businesses. Furthermore, this study also found the positive influence of TPM on the organization's financial performance. Further, the p values of this study are 0.045. It means that the TPM has a significant impact on organizational performance.

H4: ERP significantly moderates the relationship between JIT and organizational performance.

The hypothesis concerning ERP has a moderating influence on JIT production and organizational performance. Furthermore, the researcher investigated that JIT is a kind of inventory control that necessitates strong association with suppliers so that raw resources arrive when manufacturing is arranged to initiate, but not prior. The notion is to keep as little inventory on hand as likely to accomplish demand. Danese et al. (2012) stated that all JIT manufacturing strategies significantly impact an organization's efficiency and product delivery. JIT supply strategies have also had a moderating influence on the link between JIT manufacturing and product delivery. Moreover, this study also found the moderating influence of ERP on the organization's performance. Further, the p-value of this study is 0.423. Hence, ERP insignificantly moderates the relationship between JIT and

organizational performance. This may be because ERP is a push-based strategy, and JIT is a pull-based strategy. Further study should be done in future to find out the reason.

H5: ERP significantly moderates the relationship between TQM and organizational performance.

Based on the findings of this study, the hypothesis that ERP has a moderating influence on TQM and operational performance is supported. TQM may also have an important and optimistic influence on worker and organizational improvement. Firms may build and preserve cultural standards that confirm long-term achievement for both customers and the firm by having all personnel focuses on the excellent organization and systematic development. Furthermore, Valmohammadi et al. (2015) said that organizational culture has a strong influence on an organization's success. Organizations have concentrated on TQM adoption since it has a highly favourable influence on an organization's performance. Thus, it can be claimed that TQM has a favourable impact on an organization's operational performance. Furthermore, this study found that ERP influence on TQM p-value is 0.017 on operational performance, which means the ERP significantly moderates the relationship between TQM and organizational performance.

H6: ERP significantly moderates the relationship between TPM and organizational performance.

The hypothesis concerning ERP has a moderating influence on TPM and operational performance. Further, the researcher discovered that TPM promotes efficiency, control, and profitability. A strong TPM provider will also provide an ERP-agnostic solution. Furthermore, Bashar et al. (2020) said that enterprise resource planning and TPM, directly and indirectly, mediate an organization's operational performance. Furthermore, this study found ERP influence on TPM; the p-value is 0.016 on operational performance, which means the ERP significantly moderates the relationship between TPM and organizational performance.

5.3 Research Implications

Managers of manufacturing companies can benefit from this study's findings. They will better grasp lean manufacturing processes, which might improve manufacturing companies' long-term viability. The findings benefit manufacturing organizations, which may then update the lean manufacturing model in light of the selected lean manufacturing practices that contribute most to long-term success. Due to their positive and substantial influence on organizational performance, process and equipment, product design, supplier relationships, and customer interactions should be combined to enhance the firm's present operational and financial performance. When improving the effects of process and equipment practices and supplier relationships on long-term performance, firms should focus on cultivating a lean culture. On the other side, the theoretical implications of this research are that this research contributes to the academic literature on lean manufacturing by highlighting the importance of lean manufacturing processes in achieving long-term success for the organization. This research adds to the existing body of information by examining how lean culture and manufacturing methods interact to affect long-term productivity.

5.4 Limitations and Future Research

The study accomplishes its aims. However, there are limitations to be considered before the results are extrapolated to the broader population. First, it is essential to note that the study is cross-sectional, so it cannot provide light on how performance evolves. Therefore, long-term research is required to accurately depict the impact of lean manufacturing processes on business output. In addition, data were obtained from a variety of sectors. This study’s conceptual framework may be tested in other nations in future research, expanding the applicability of the findings. Since the effect of lean manufacturing strategies on organizational performance may differ from one industry to another, future studies will need to narrow their focus to a single sector.

References

Ahuja, I. P. S. & Khamba, J. S. (2008). An evaluation of TPM initiatives in Indian industry for enhanced manufacturing performance. *International Journal of Quality & Reliability Management*.32(11), 51-53.

Alam, M. (2022). Supply Chain Management Practices and Organizational Performance in Manufacturing Industry. *South Asian Journal of Social Review, 1*(1), 42-52.

Alase, A. (2017). The interpretative phenomenological analysis (IPA): A guide to a good qualitative research approach. *International Journal of Education and Literacy Studies, 5*(2), 9-19.

Ali, S. B. (2022). Industrial Revolution 4.0 and Supply Chain Digitization. *South Asian Journal of Social Review, 1*(1), 21-41.

Amjad, S. (2022). Role of Logistical Practices in Quality Service Delivery at Supermarkets: A Case Study from Pakistan. *South Asian Journal of Operations and Logistics, 1*(1), 39-56.

Anwar, M. F. A. (2022). The Influence of Inter-Organizational System Use and Supply Chain Capabilities on Supply Chain Performance. *South Asian Journal of Operations and Logistics, 1*(1), 20-38

Asif, K. (2022). The Impact of Procurement Strategies on Supply Chain Sustainability in the Pharmaceutical Industry. *South Asian Journal of Social Review, 1*(1), 53-64.

Ayaz, J. (2022). Relationship between Green Supply Chain Management, Supply Chain Quality Integration, and Environmental Performance. *South Asian Management Review, 1*(1), 22-38.

Baloch, N. & Rashid, A. (2022). Supply Chain Networks, Complexity, and Optimization in Developing Economies: A Systematic Literature Review and Meta-Analysis. *South Asian Journal of Operations and Logistics, 1*(1), 1-13.

Bashar, A., & Hasin, A. A. (2019). May. Impact of JIT production on organizational performance in the apparel industry in Bangladesh. In *Proceedings of the 2019 International Conference on Management Science and Industrial Engineering*, *129*(2), 251-261.

Bashar, A., Hasin, A. A. & Jahangir, N. (2020). Linkage between TPM, people management and organizational performance. *Journal of Quality in Maintenance Engineering*. *20*(4), 471-483.

Basit, A. (2022). The Influence of Green Supply Chain Management on Sustainable Performance. *South Asian Management Review, 1*(1), 49-66.

Belekoukias, I., Garza-Reyes, J. A., & Kumar, V. (2014). The impact of lean methods and tools on the operational performance of manufacturing organizations. *International Journal of production research*, *52*(18), 5346-5366.

Bellisario, A., & Pavlov, A. (2018). Performance management practices in lean manufacturing organizations: a systematic review of research evidence. *Production Planning & Control*, *29*(5), 367-385.

Brah, S. A., & Lim, H. Y. (2006). The effects of technology and TQM on the performance of logistics companies. *International Journal of Physical Distribution & Logistics Management*, 36(3), 192-209.

Danese, P., Romano, P., & Bortolotti, T. (2012). JIT production, JIT supply and performance: investigating the moderating effects. *Industrial Management & Data Systems*. *11*(4), 1112-1120

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. J*ournal of Marketing Research, 18*(1), 39-50.

Fullerton, R.R. and Wempe, W.F., 2009. Lean manufacturing, non-financial performance measures, and financial performance. *International journal of operations & production management*. *22*(4), 320-340.

Hashmi, A. R., & Mohd, A. T. (2020). The effect of disruptive factors on inventory control as a mediator and organizational performance in Health Department of Punjab, Pakistan. *International Journal of Sustainable Development & World Policy, 9*(2), 122-134. DOI: 10.18488/journal.26.2020.92.122.134.

Hashmi, A. R., Amirah, N. A., & Yusof, Y. (2020a). Mediating effect of integrated systems on the relationship between supply chain management practices and public healthcare performance: Structural Equation Modeling. *International Journal of Management and Sustainability, 9*(3), 148-160. DOI: 10.18488/journal.11.2020.93.148.160.

Hashmi, A. R., Amirah, N. A., & Yusof, Y. (2021a). Organizational performance with disruptive factors and inventory control as a mediator in public healthcare of Punjab, Pakistan. *Management Science Letters, 11*(1), 77-86. DOI: 10.5267/j.msl.2020.8.028.

Hashmi, A. R., Amirah, N. A., Yusof, Y., & Zaliha, T. N. (2020b). Exploring the dimensions using exploratory factor analysis of disruptive factors and inventory control. *The Economics and Finance Letters, 7*(2), 247-254. DOI: 10.18488/journal.29.2020.72.247.254.

Hashmi, A. R., Amirah, N. A., Yusof, Y., & Zaliha, T. N. (2021b). Mediation of inventory control practices in proficiency and organizational performance: State-funded hospital perspective. *Uncertain Supply Chain Management*. *9*(1), 89-98. DOI: 10.5267/j.uscm.2020.11.006.

HassabElnaby, H.R., Hwang, W. and Vonderembse, M.A., 2012. The impact of ERP implementation on organizational capabilities and firm performance. *Benchmarking: An International Journal*. *31*(10), 771-785.

Hunaid, M., Bhurgri, A. A., & Shaikh, A. (2022). Supply Chain Visibility in Leading Organizations of the Shipping Industry. *South Asian Journal of Social Review, 1*(1), 8-20.

Iranmanesh, M., Zailani, S., Hyun, S. S., Ali, M. H. & Kim, K., (2019). Impact of lean manufacturing practices on firms' sustainable performance: lean culture as a moderator. *Sustainability, 11*(4), 1112-1120

Khalfallah, M. & Lakhal, L., (2020). The impact of lean manufacturing practices on operational and financial performance: the mediating role of agile manufacturing. *International Journal of Quality & Reliability Management*.*150*(2), 150-158.

Muzammil, M. (2022). Evaluating the Factors to Improve the Organizational Performance. *South Asian Management Review, 1*(1), 39-48.

Phan, A. C., Nguyen, H. T., Nguyen, H. A. & Matsui, Y. (2019). Effect of total quality management practices and JIT production practices on flexibility performance: Empirical evidence from international manufacturing plants. *Sustainability*, *11*(11), 3093- 3073

Rasheed, T. (2022). Supply Chain Sustainability Through Green Practices in Manufacturing: A Case Study from Pakistan. *South Asian Journal of Operations and Logistics, 1*(1), 57-71

Rashid, A. & Rasheed, R. (2022). A Paradigm for Measuring Sustainable Performance Through Big Data Analytics–Artificial Intelligence in Manufacturing Firms. *Available at SSRN 4087758*.

Rashid, A. (2016). Impact of inventory management in downstream chains on customer satisfaction at manufacturing firms. *International Journal of Management, IT and Engineering*, *6*(6), 1-19.

Rashid, A., & Amirah, N. A. (2017). Relationship between poor documentation and efficient inventory control at Provincial Ministry of Health, Lahore. *American Journal of Innovative Research and Applied Sciences, 5*(6), 420-423.

Rashid, A., Ali, S. B., Rasheed, R., Amirah, N. A. & Ngah, A. H. (2022). A paradigm of blockchain and supply chain performance: a mediated model using structural equation modeling. *Kybernetes, Vol. ahead-of-print No. ahead-of-print*. https://doi.org/10.1108/K-04-2022-0543

Rashid, A., Amirah, N. A., & Yusof, Y. (2019). Statistical approach in exploring factors of documentation process and hospital performance: a preliminary study. *American Journal of Innovative Research and Applied Sciences, 9*(4), 306-310.

Rashid, A., Amirah, N. A., Yusof, Y., & Mohd, A. T. (2020). Analysis of demographic factors on perceptions of inventory managers towards healthcare performance. *The Economics and Finance Letters, 7*(2), 289-294. DOI: 10.18488/journal.29.2020.72.289.294

Rashid, A., Rasheed, R., Amirah, N. A., Yusof, Y., Khan, S., & Agha, A., A. (2021). A Quantitative Perspective of Systematic Research: Easy and Step-by-Step Initial Guidelines. *Turkish Online Journal of Qualitative Inquiry, 12*(9), 2874-2883.

Shaheen, S. (2022). Quality management and operational performance: a case study from Pakistan. *South Asian Journal of Operations and Logistics, 1*(1), 14-19.

Singh, K. & Ahuja, I. S. (2015). An evaluation of transfusion of TQM-TPM implementation initiative in an Indian manufacturing industry. *Journal of Quality in Maintenance Engineering*.*16*(4), 99-112

Taj, S. & Morosan, C. (2011). The impact of lean operations on the Chinese manufacturing performance. *Journal of Manufacturing Technology Management*. *8*(11), 2080- 2090

Uddin, S. Q. (2022). Supply Chain Integration, Flexibility, and Operational Performance. *South Asian Management Review, 1*(1), 1-21.

Valmohammadi, C. & Roshanzamir, S. (2015). The guidelines of improvement: Relations among organizational culture, TQM and performance. *International Journal of Production Economics*, *164(2)*, 167-178.

Victory, G. O., Lizzie, O. A. & Olaitan, A. A. (2022). Climate-Smart Agricultural Practices at Oyo State-Nigeria. *South Asian Journal of Social Review, 1*(1), 1-7.

Yang, M. G. M., Hong, P. & Modi, S. B. (2011). Impact of lean manufacturing and environmental management on business performance: An empirical study of manufacturing firms. *International Journal of Production Economics*, *129*(2), 251-261.

Yusuf, Y. Y., & Adeleye, E. O. (2002). A comparative study of lean and agile manufacturing with a related survey of current practices in the UK. *International Journal of Production Research*, *40*(17), 4545-4562.