

## Impact of lean manufacturing practices on the performance of manufacturing industries

Danial Razzaq <sup>1\*</sup>

<sup>\*1</sup> Faculty of Business Administration, Iqra University, Karachi, Pakistan

\*Corresponding email: denial.razzaq11988@iqra.edu.pk

### Article History

Received: 02 July 2023  
Revised: 12 January 2024

### JEL Classification

R41  
G14  
Q56

### ABSTRACT

In this paper, we aim to check the impact of lean manufacturing practices on the performance of the manufacturing industry in Pakistan. The three practices involve customer involvement, supplier involvement, and 5s and their effect on the industry's performance. For this purpose, we used a random sampling technique with a sample of 20 questions, a question-based questionnaire designed under the supervision of expert supply chain specialists from different manufacturing industries and authentic research journals. The key finding of this research paper is that we have seen the positive significance of lean practice on the performance of Pakistan's manufacturing industry.

**Keywords:** Lean supply chain manufacturing practices, Manufacturing, Supply chain management, SCM, Performance, Customer involvement, Supplier involvement

### Citation of this article:

Razzaq, D. (2024). Impact of lean manufacturing practices on the performance of manufacturing industries. *South Asian Journal of Operations and Logistics*, 3(2), 113-126. <https://doi.org/10.57044/SAJOL.2024.3.2.2432>

## **Impact of lean manufacturing practices on the performance of manufacturing industries**

### **1. Introduction**

Toyota fostered the Toyota Creation Framework in Japan. This idea advanced into lean assembly in the USA and afterward diffused to other economies. Albeit various examinations have detailed the huge advantages of lean appropriation in huge ventures (LEs) (Shah & Ward, 2003; Belekoukias et al., 2014; Bevilacqua et al., 2017), a tone of distrust actually remains in regards to its effect in small and centered organizations (Hashmi, 2023). The advantages of lean selection should be completely thought of and assessed in SMEs. Essentially, to lean examination, when all is said and done, lean selection in SMEs has as of late acquired consideration in non-industrial nations. For example, Hindustan is a country in which small manufacturing industries represent 45% of exports, 45 percent of the total manufacturing output, and employment over 80 million people.

### **1.1 Background**

The Lean Manufacturing (LM) framework was first brought to bear by the Toyota Engine Organization in the late 1950s and was named Toyota Creation Framework. In literature, it has been highlighted that to outline manufacturing measures without waste. Lean assembly comprises a work-bench reasoning that fulfills client needs in the briefest conceivable time at the greatest and least expense. An expansion in efficiency will influence productivity in a positive way (Tangen, 2005; Baloch & Rashid, 2022), battle associations referred to waste elimination, and minimize affordability issues by giving predominant client assistance. Waste elimination creation is adeptly created by different credit-seeking thoughts and attributes, which are frequently hard to quantify straightforwardly. Columbus et al. (2015) additionally guarantees that associations receive lean assembly to control squander and to make more noteworthy worth. Lean assembling is giving awards to the different associations worldwide as far as expanded efficiency, quality, and consumer loyalty. In LM, all exercises that draw in assets without esteem creation are named as waste and should be altogether uncovered (Chauhan & Singh, 2013; Chen & Chang, 2013; Hashmi, 2022).

Lean assembly has been embraced by organizations around the world for quite a few years and, furthermore, stood out enough to be noticed by the scholarly community (Jasti & Kodali, 2015). Countless distributions have examined the connection between lean assembly, appropriation, and hierarchical execution. Something very similar to the topographical area or potentially the industry appears to be suitable and reasonable in its disposition with lean assembly, which a few creators recommend as firmly setting subordinates (Lewis & Talalayevsky, 2004; Marodin & Saurin, 2014). Efficiency is a more appropriate measure to screen producing greatness over the long haul. Efficiency is, notwithstanding, firmly connected to benefit. The lean assembly framework has an alternate arrangement of rehearsals for improving profitability. In the lean assembly climate, the significant spotlight is on the disposal of waste (MUDA) of different kinds, like space, time, energy, movements, materials, inventories, and deformities.

### **1.2 Problem Statement**

Manufacturing industries in Pakistan are producing multiple products according to their product assembly line. Every manufacturer goal higher production target as well as sales. The manufacturing process contains number of default problems that creates huge losses and wastages due to which the goals are unachievable. Pakistani power sector experiences shortcomings that cost the economy \$18 billion or 6.5 percent of Gross domestic product in monetary year 2015. Very nearly one-fifth of power created is lost through poor infrastructure and old technological practices. Pakistani manufacturing industries creates huge wastage in terms of productive loss, financial losses, environmental disturbance, skills unused, improper use of skilled labor, utilities unwanted usage and bear unwanted losses. Study is conducted to make possible use of lean

manufacturing practices (LMPs) in all the areas of manufacturing sector to reduce wastage and increase productivity. LMPs were used to reduce waste and make the process clear of waste and unwanted stuff. In this study, we will focus on the wastages that are creating a disturbance in between the manufacturing processes and reduce waste and losses by applying lean manufacturing practices with certain tools and tactics.

### 1.3 Research Requirements

Every research should be conducted on some specific area or process to get the results that will help out in a good manner for those who follow that research. We are working on the impacts of LMPs on the performance of manufacturing industries so the thing we needed the most are the officials who are working on top management posts in different organizations who are responsible for the performance of that specific industry they are working for. Top line managers including general manager, deputy manager, and senior manager with in charge level staff are required to work with lower staff. We need to make a certain questioner that will be answered by top management staff, middle management staff and some of the working practitioners. The results will prove the hypothesis is significant or insignificant. Following are the research objectives followed by research questions:

*RO1: In our research, the objectives for carrying out research are mentioned below:*

*RO2: Customer involvement significantly affects PM.*

*RO3: Supplier involvement significantly affects PM.*

*RO4: 5's significantly affect PM.*

Lean manufacturing aims to reduce unwanted stuff from the process on which we are applying it. Certain practices are required to apply for the successful implementation of lean processes in any process that will help reduce garbage in that process.

*RQ1: General research questions that will cover the whole scenario of the study are:*

*RQ2: Does customer involvement significantly affect PM?*

*RQ3: Does supplier involvement significantly affect PM?*

*RQ4: Does 5's significantly affect PM?*

The question that will prove the hypothesis will be in detailed question form. These are the questions that only give a broader overview of the research.

## 2. Literature Review

### 2.1 Literature Review

A literature review enrolls the previous research that was already done by other researchers on the same topic, or relatively, some aspects are the same. This section includes the already-researched areas that were found by other researchers and allows a new researcher to understand the topic in a better way and start his or her research in a new manner. A lean inventory network ought to permit a progression of products, administrations, and innovation from providers to clients without squandering the vast majority of the investigations, which have been confined to a specific area rather than a speculation of the LSCM structure (Perez et al., 2010).

### 2.2 Lean Supply Chain Manufacturing (LSCM)

Lean supply chain manufacturing practices involve benefits. In this journal, we are basically working on three lean practices, including customer's involvement, supplier's involvement, and 5'S. We study the effect of these three lean practices on the performance of the manufacturing industry. For a manufacturing firm, these three practices are very important because they are purely mixed into the firm cycle and directly affect the performance measures of any firm. For any firm, customers are the main asset that is centered.

The customer's involvement is the key to success in a successful business movement. Today's firms are working on competitive advantage for the products they are offering. As much as the product is customized, the customer's involvement is evident (Rashid & Rasheed, 2024). Supplier's involvement is the main concept that lean manufacturing practices emphasize. Suppliers in terms of raw materials are as important as oxygen is for human beings. Suppliers' timely responses make the whole supply chain system more efficient and timely (Rashid et al., 2024; Rashid & Rasheed, 2023). 5S is a very important lean practice for a firm to achieve lean manufacturing and eliminate waste to achieve maximum productivity, enhance its performance in terms of financial outcomes, and capture a maximum market share in the sector in which the firm is working. It is a basic and very important tool to practice lean manufacturing within the firm. Lean assembly tends to be one of the most awful things that can happen to any undertaking, and that is waste.

### **2.3 Relationship Between Customer's and Supplier's Involvement and Performance**

A customer is an individual or business that buys another organization's products or services. Organizations habitually study their clients' profiles to tweak their marketing approaches and tailor their stock to pull in the most clients. Customers are consistently collected by their economics, similar to age, race, sex, ethnicity, pay level, and geographic region, which all might help associations foster a set of "best customers" or "customer personas." This information helps associations broaden existing customer associations and show up at unseen client masses to extend traffic (Rashid et al., 2023). The supply chain is valuable to speed up item improvement and critical thinking (Rasheed & Rashid, 2023). In a unique climate, outer collaboration with providers and clients increases the productivity of the use of specific information in item advancement (Rasheed et al., 2023). Some "accepted procedures" then again, another meta-investigation found that SCI positively affects client data and may produce natural thoughts, prompting helpless development execution (Frishammar & Horte, 2005). At times, an excess contribution from the client may prompt unnecessary interruptions and disarray, bringing down the nature of the data for item advancement (Bonner, 2010). Earlier examinations of SCI in NPD show variety in extent, measurable significance, and heading of connections contemplated. This may mirror the challenges of executing SCI for item improvement. The above literature review briefly elaborates on the significance of supplier customers' involvement in the performance of the manufacturing industry while manufacturing a new product design (NPD) and during the ongoing process of the manufacturing industry.

### **2.4 Relationship Between 5's and Performance**

The comprehension of 5S is intricate and set up in Japan as it rises up out of a methodology that considers it to be life shrewdness, polished ordinary. Due to this establishment, 5S has been remembered for the executive's practice and adds to cost viability by boosting both productivity and viability. The execution of 5S can likewise uncover covered-up issues that may have something else stayed unseen. 5s framework assists with figuring out a working environment to expand proficiency, decrease waste, and upgrade quality and efficiency by means of a coordinated climate. 5S isn't just valuable for improving the work space; in addition, they rise cycle and item quality principles, decrease and upgrade lead time, and furthermore diminish working expenses and improve measure execution. 5S is a helpful technique for establishing an association and fanning out a plan. It can likewise improve correspondence and assist workers with building up their qualities to diminish vacation, lead time, stock, abandons, faculty injury, and related expenses. Most past investigations show a positive connection between 5s and efficiency. A portion of the finding is also somewhat associated with assembly profitability.

The intensity of the organization is advanced, as it is the best approach to building productivity, a portion of the overall industry, and diminishing production expenses (Rashid et al., 2022a; 2022b). The presentation is an upgrade of new changes made to the 5S procedure. 5S practices are received in each firm or association's day-to-day routine. The entire framework is a set of best approaches that enhance the execution of a lean practice. 5S execution enhances production execution by getting the workplace sorted out, normalizing the work stream, and delegating clear responsibility

to representatives. 5S is executed in the fabricating segment with the need in contrast with another segment (Singhi et al., 2014). Industrial execution is completely influenced by one of the 5 lean practices, which will be estimated regarding improvements in terms of profitability, quality, laborer fulfillment, lead time, and a new item plan. 5S is the way towards making more beneficial individuals, even bosses and workers, and more beneficial organizations through high instruction, inspiration, and great practice of 5S.

The 5S guideline impacts total productive maintenance in a straightforward and roundabout way, which gives a better state and decreases six major misfortunes. The effect of carrying out the 5S procedure will be total productive maintenance in the form of efficiency, conveyance, wellbeing, and assurance. Specialists broadcast as representatives can't get familiar with the 5S execution appropriately, which hinders the normalization of the 5S processing plant (Sharma et al., 2021).

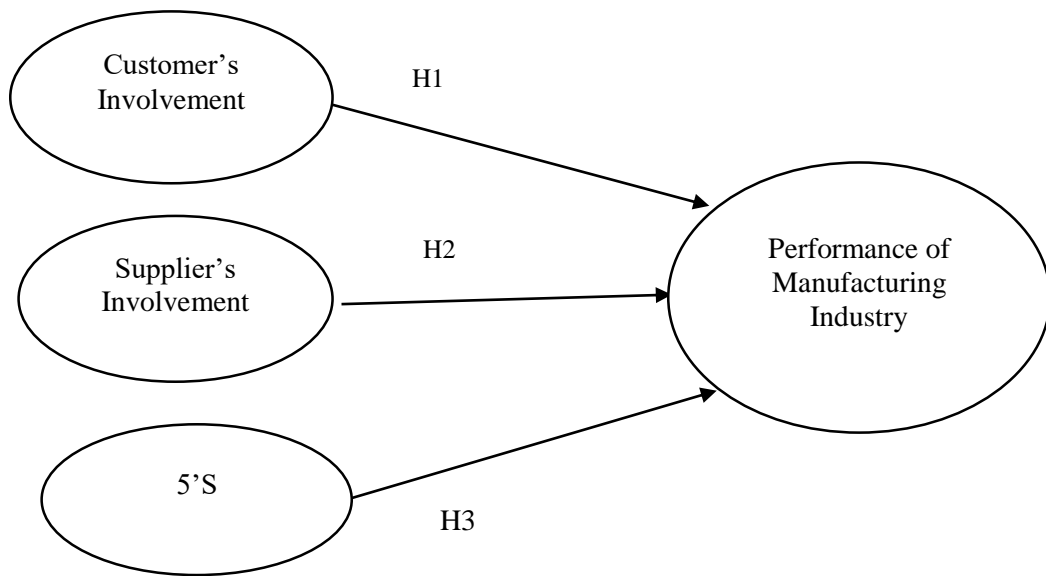


Figure 1: Conceptual frame work  
Source: Author's creation

## 2.5 Hypothesis

- H1. The customer's involvement significantly affects PM.
- H2. The supplier's involvement significantly affects PM.
- H3. 5'S significantly affects PM

## 3. Research Methodology

Research methodology is very important to know the practicality of the research (Rashid & Rasheed, 2022). In this section, the researcher talks about the methodology, research approach, method of data collection, sampling design, and ethical considerations that are focused on during the study of this research. The population that is being selected to research the scenario that the researcher selects is very important (Rashid et al., 2019). The experienced professionals are required to provide their input for the authenticity of the research. In this research, we have applied three lean practices involving customer's involvement, supplier's involvement, and 5'S to check the performance of manufacturing industries. For this purpose, we have applied the random sampling technique. Random sampling is very important in this aspect because every sample has an equal chance of being selected (Hashmi et al., 2021a; 2021b).

### 3.1 Research Approach

The research approach is an idea plan and a system for research that lengthens the means from wide suppositions to point-by-point techniques for data assortment, investigation, and translation (Rashid & Amirah, 2017). The trendy preference consists of which technique should be applied to have a look at a point. Illuminating this preference should be the philosophical presumptions the scientist brings to the investigation, the method of request (referred to as study plans), and specific exam strategies for data assortment, investigation, and understanding (Hashmi et al., 2020a; 2020b). Quantitative studies regularly convert into the use of genuine research to establish the affiliation between what is thought and what may be found through studies (Khan et al., 2022). Thus, breaking down facts with quantitative strategies calls for a comprehension of the connections amongst elements through both expressive and inferential insights (Khan et al., 2021). Graphic measurements help with drawing deductions about populations and gauging boundaries (Rashid et al., 2020). Inferential information relies on the illustrative insights and suppositions that sum up the population from a selected test.

### **3.2 Method of Data Collection**

The data collection method involved qualitative and quantitative research approaches (Rashid et al., 2021). In a qualitative approach, data is collected through face-to-face interviews, online interviews, or discussions (Agha et al., 2021). In quantitative research, the data collection method is to prepare a questioner with the help of experts and collect data using questioners (Rashid, 2016). The main thing for acquiring essential data in functional examination is in the form of questioners, because of the way that the analyst can settle on the instance and the types of questions to be posed. Every respondent is noted to reply to an indistinguishable rundown of inquiries mixed in order to forestall bias (Haque et al., 2021). At first, the survey configuration becomes coded and stirred up from a specific subject depending on uniform constructions (Hashmi & Mohd, 2020; Khan et al., 2023a). The studies relied on a five-point Likert scale. Responses were given to each declaration; a Likert-type scale is used, where 1 = "strongly disagree" and 5 = "strongly agree." The responses were summed up to convey a score for the activities.

### **3.3 Sampling Design**

#### **3.3.1 Random sampling**

Random sampling is a piece of the testing strategy where each example has a comparable probability of being picked. Each example protects a fair-minded portrayal among the populace. This test will help us recognize the connections and conditions between factors; these strategies will assist us in clarifying our illustrative factors in the future (Hwang & Min., 2015). The target population involves supply chain professionals, practitioners, and different lower, middle, and upper management staff of different manufacturing organizations who have worked on lean manufacturing in manufacturing industries (Alrazehi et al., 2021; Das et al., 2021). We take different members of each firm and target six different firms for the questioner's response. A questionnaire consisting of 20 questions is made with the help of expert supply chain professionals and previous research journals from different well-known publishers. The respondents who are filling out the questionnaires are aged between 18 and 50 years, male and female, responding to the study. Random sampling techniques will be used in our research to determine the significance of lean manufacturing practices on the performance of the manufacturing industry. A review drawn indiscriminately is proposed to be an unbiased delegate of the entire population (Cousins et al., 2019; Haq et al., 2023; Khan et al., 2023b)

### **3.4 Ethical Consideration**

This is an essential objective: the scientist's experience and ends are considered right, genuine, and fair; all moral contemplations distinguish clarifications and elaborate moral issues that should be considered in human exploration; and all moral contemplations are centered on reality. We accept that the reader will actually want to see these morals, customs, cycles, and assumptions in this examination. In the overall segment of the investigation, the reader can, without much of a stretch, see

good and bad separation. Significant and precise sources are utilized, making it more trustworthy and cultivating common regard among scientists.

**4. Results and Findings**

**4.1 Descriptive Profile of the Data**

We have taken our responses with different genders having different age groups and experience varying respondent to respondent. Total of 213 responses were collected from which you can see in below table 1, 31.9 % female respondents and 68.1% male respondents reply to research questioner and you can see in below table 1, 50.7% respondents are aged between 18-25, 12.7% are aged between 26-35 and 36.6% are aged between 36-50. As you can see in below table 1, 15% respondents have less than 1 year of experience, 35.7% have 2-5 years of experience, 12.7% have 6-8 years of experience and 36.6% have 8 and above years of industrial experience. As you can see in below table 1, 27.2% of lower management staff responds, 64.8% of middle management and 8% of top management staff take part in responding to our research questioner.

Table 1: Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	68	31.9	31.9	31.9
	Male	145	68.1	68.1	100.0
	Total	213	100.0	100.0	
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2 to 5	76	35.7	35.7	35.7
	6 to 8	27	12.7	12.7	48.4
	8 and above	78	36.6	36.6	85.0
	Less than 1	32	15.0	15.0	100.0
	Total	213	100.0	100.0	
		frequencies	Percent	Valid Percent	Cumulative Percent
Valid	18-25	108	50.7	50.7	50.7
	26-35	27	12.7	12.7	63.4
	36-50	78	36.6	36.6	100.0
	Total	213	100.0	100.0	
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Lower Management Staff	58	27.2	27.2	27.2
	Middle Management Staff	138	64.8	64.8	92.0
	Top Management Staff	17	8.0	8.0	100.0
	Total	213	100.0	100.0	

Source: SPSS output

**4.2 Model Validation**

For checking model consistency; we are going for performing reliability test for each factor. If Alfa is between 0.6 to 0.7 reliability of factors is acceptable, more than 0.8 is best level of reliability. But value above 0.9 is not acceptable. Over repetitiveness is shown if value increased from 0.9 (Hashmi et al., 2021a). Table 2 illustrates construct’s reliability.

**4.2.1 Reliability analysis**

Table 2: Customer’s Involvement / Reliability statistics

Cronbach’s $\alpha$	Standardized Cronbach $\alpha$	No of items
.751	.747	5

Source: SPSS output

Table 5 explained the value of CA is 0.751 higher than 0.7. Hence we can say that all items of independent variable i.e., customer’s involvement are reliable.

**4.2.2 Supplier’s involvement RS**

Table 3: Reliability statistics

Cronbach’s $\alpha$	Standardized Cronbach $\alpha$	No of items
.871	.870	5

Source: SPSS output

Table 3 explained the value of CA is 0.871 higher than 0.7. Hence we can say that all items of independent variable i.e., Supplier’s involvement are reliable.

Table 4: Reliability statistics

Cronbach’s $\alpha$	Standardized Cronbach $\alpha$	No of items
.786	.785	5

Source: SPSS output

Table 4 explained the value of CA is 0.786 higher than 0.7. Hence we can say that all items of independent variable i.e., 5’S are reliable.

**4.2.3 Performance of manufacturing industry (RS)**

Table 5: Reliability statistics

Cronbach’s $\alpha$	Standardized Cronbach $\alpha$	No of items
.803	.801	5

Source: SPSS output

Table 5 explained the value of CA is 0.803 higher than 0.7. Hence we can say dependent variable i.e.; Performance of manufacturing industry is reliable.

**4.3 Hypotheses Testing**

**4.3.1 R, R-square and adjusted R-square**

Table 6: Summary of Model

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson	
					R Square Change	F Change	df1	df2	Sig. Change		
1	.590 <sup>a</sup>	.349	.339	.5344	.349	37.297	3	209	.000	2.192	
a.	Predictors: (constant), 5S, C, S										
b.	Dependent variable: PM										

Source: SPSS output

Hypothesis testing is done in software named SPSS using linear regression. The model summary table 6 shows the strength of the connection between the dependent variable and the model. R (numerous relationship coefficients) is the direct connection between the model's anticipated worth and noticed qualities. As much as the value of R is high, it denotes a strong connection. Potential upsides of the relationship coefficient (R) range from -1 to +1, with -1 demonstrating an entirely direct negative, i.e., opposite, connection (inclining lower), and +1 showing a completely straight certain relationship (slanting vertical). In the abovementioned table 6 summary of the model, the R value is 0.590, showing a moderate association between dependent and independent variables. R squared elaborates on how well the regression model fits the observed data. It shows the scatter of the data points around the fitted regression line. Its value ranges from 0 to 1. Table 6, summary of the model, shows that r squared is 0.349, which is adequate. Table 6, summary of the model, shows that R square is 0.399, which is close to 0.349, which is good for the model.

**4.3.2 ANOVA**

Table 7: ANOVA

Model	Sum of squares	df	Mean Square	F	Sig.
-------	----------------	----	-------------	---	------



1	Regression	31.956	3	10.652	37.297	.000 <sup>b</sup>
	Residual	59.691	209	.286		
	Total	91.648	212			

Dependent variable: PM  
 Predictors: (constant), 5S, C, S

Source: SPSS output

In research, confidence interval of 95% is allowed. Results are significant if sig<0.05. In above table 7 the sig value is 0.000 which is less than 0.005 that proves the results of our research is significant.

### 4.3.3 Coefficients

Table 8: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
		1	(Constant)	1.162			.323		3.599	.000
	C	.233	.077	.192	3.028	.003	.081	.385	.773	1.294
	S	.333	.066	.377	5.038	.000	.203	.464	.557	1.794
	5S	.145	.066	.149	2.188	.030	.014	.276	.674	1.485

Dependent variable, PM

Source: SPSS output

From sig values from above table 8 interprets that every one of the factors have importance. If sig < 0.05 the results are significant. In like way, all free factors affect subordinate variable. All sig values are under 0.05. VIF regard from collinearity shows that autonomous factors have a worth under 10 which infers there is no multicollinearity, the impacts declared by model are pure and one's impact isn't suffering impact of other free factors. In the above table, we can expand that customer's involvement, supplier's involvement and 5'S altogether affects the performance of manufacturing industry.

### 4.3.4 Summary of hypothesis testing

In this test, below table 9 shows which of the hypothesis is Accepted or Rejected. Since the sig. values shows that customer's involvement, supplier's involvement and 5's has a significant effect on the performance of manufacturing industry. Hence, all the hypotheses are supported.

Table 9: Summary of Hypothesis Testing

Hypothesis	Results
H1. CI has a significant effect on PM.	Accepted
H2. SI has a significant effect on PM.	Accepted
H3. 5'S has a significant effect on PM.	Accepted

Source: Based on SPSS results

## 5. Conclusion, Discussion, Implications, Limitations, and Recommendations

### 5.1 Conclusion

We examine the performance of the manufacturing industry in terms of lean practices. We have taken 213 respondents from different manufacturing companies in Karachi, Pakistan. We have observed that if customer's involvement, supplier's involvement, and 5's (lean practices) are properly applied in manufacturing industries, then the performance of the manufacturing industry would be increased. These practices would eliminate the waste and downtime within the cycles, and ultimately, the performance would be positively affected.

### 5.2 Discussion

The performance of manufacturing industries needs to increase. For this purpose, processes should be lean to achieve maximum performance. The customer's involvement purely increases performance. If we add customers' feedback and design our product accordingly, then performance will increase. Supplier's involvement in a manufacturing industry is very important in terms of quality material availability and time. 5's is a tool that will eliminate waste from the cycles of operations and allow enough time to increase performance in terms of increased production. Lean practices allow us to eliminate waste and increase productivity and performance. The performance of the manufacturing industry would be increased if lean practices, i.e., customer's involvement, supplier's involvement, and 5's, were properly applied. Customers are the main focus of any business, and if we allow them to coordinate and facilitate them according to their needs and wants, their involvement makes our targets more reliable and easy to reach (Li et al., 2006) Suppliers are the core concern for any successful business operation in terms of production, raw material handling, and other timely operations (Jaworski & Kohli, 1993). Wastages within the processes decrease performance that ultimately bears by the organizations. Lean practices allow industries to eliminate them and make their processes lean.

### **5.3 Implications**

The research allows the reader to study the different theoretical implications of lean practices. Lean practices allow performance enhancement in terms of eliminating waste in the process we are applying them; hardly any observational examinations have researched the relationship between these developments (Jayaram et al., 2008). So the theoretical implications of research are very helpful for the new researchers. This research allows managers, heads of departments, in-charges, directors, and top management staff to apply these practices practically in their processes, and they will get the most out of it. That's going to allow them to increase the productivity and performance of their industries. Organizational implications are very beneficial in terms of business, as we have discussed suppliers' and customers' involvement in a process that would ultimately affect the business process. (Schenberg, 1995; Flynn et al., 1999; Jayaram et al., 2008).

### **5.4 Limitations**

Like other explorations and studies, this concentration additionally has a few impediments. First and foremost, it has a time imperative as it was done in a brief timeframe. Furthermore, it was a self-financed study, and no outside subsidizing was associated with the culmination of the examination. Thirdly, it likewise had geographical requirements as it was directed at a single city, Karachi, Pakistan. Fourthly, I have applied only three lean practices. So, adding other lean practices will increase performance more positively.

### **5.5 Recommendation**

We have studied on a limited sample size of 213 respondents from different firms, so in the future, the study would be carried out on a larger sample size to get more reliable and clear results. Furthermore, we can apply the research outside Pakistan, as I have carried out my research in Pakistan, so other international manufacturing industries will be part of the research. I have focused mainly on the textile, pharmaceutical, and automotive industries in my research. In the future, many other manufacturing industries will be part of this research.

### **References**

- Agha, A. A., Rashid, A., Rasheed, R., Khan, S., & Khan, U. (2021). Antecedents of Customer Loyalty at Telecomm Sector. *Turkish Online Journal of Qualitative Inquiry, 12*(9), 1352-1374. <https://www.tojqi.net/index.php/journal/article/view/5873/4175>
- Alrazehi, H. A. A. W., Amirah, N. A., Emam, A. S., & Hashmi, A. R. (2021). Proposed model for entrepreneurship, organizational culture and job satisfaction towards organizational performance in International Bank of Yemen. *International Journal of Management and Human Science, 5*(1), 1-9. <https://ejournal.lucp.net/index.php/ijmhs/article/view/1330/1399>

- 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. <https://doi.org/10.57044/SAJOL.2022.1.1.2202>
- Belekoukias, I., Garza-Reyes, J. A., & Kumar, V. (2014). The impact of lean methods and tools on the operational performance of manufacturing organisations. *International Journal of Production Research*, 52(18), 5346–5366. <https://doi.org/10.1080/00207543.2014.903348>
- Bevilacqua, L., Shackleton, N., Hale, D., Allen, E., Bond, L., Christie, D., Elbourne, D., Fitzgerald-Yau, N., Fletcher, A., Jones, R., Miners, A., Scott, S., Wiggins, M., Bonell, C., & Viner, R. M. (2017). The role of family and school-level factors in bullying and cyberbullying: a cross-sectional study. *BMC Pediatrics*, 17(1). <https://doi.org/10.1186/s12887-017-0907-8>
- Bonner, J. M. (2010). Customer interactivity and new product performance: Moderating effects of product newness and product embeddedness. *Industrial Marketing Management*, 39(3), 485–492. <https://doi.org/10.1016/j.indmarman.2008.11.006>
- Chauhan, G., & Singh, T. P. (2013). Resource flexibility for lean manufacturing: SAP-LAP analysis of a case study. *International Journal of Lean Six Sigma*, 4(4), 370–388. <https://doi.org/10.1108/ijlss-10-2012-0010>
- Chen, J.-M., & Chang, C.-I. (2013). Dynamic pricing for new and remanufactured products in a closed-loop supply chain. *International Journal of Production Economics*, 146(1), 153–160. <https://doi.org/10.1016/j.ijpe.2013.06.017>
- Columbus, D. A., Steinhoff-Wagner, J., Agus Suryawan, Nguyen, H. V., Hernandez-García, A., Fiorotto, M. L., & Davis, T. A. (2015). Impact of prolonged leucine supplementation on protein synthesis and lean growth in neonatal pigs. *American Journal of Physiology-Endocrinology and Metabolism*, 309(6), E601–E610. <https://doi.org/10.1152/ajpendo.00089.2015>
- Cousins, P. D., Lawson, B., Petersen, K. J., & Fugate, B. (2019). Investigating Green Supply Chain Management Practices and Performance. *International Journal of Operations & Production Management*, 39(5), 767–786.
- Das, S., Ghani, M., Rashid, A., Rasheed, R., Manthar, S., & Ahmed, S. (2021). How customer satisfaction and loyalty can be affected by employee's perceived emotional competence: The mediating role of rapport. *International Journal of Management*, 12(3), 1268-1277. <https://doi.org/10.34218/IJM.12.3.2021.119>
- Flynn, B. B., Schroeder, R. G., & Flynn, E. James. (1999). World class manufacturing: an investigation of Hayes and Wheelwright's foundation. *Journal of Operations Management*, 17(3), 249–269. [https://doi.org/10.1016/s0272-6963\(98\)00050-3](https://doi.org/10.1016/s0272-6963(98)00050-3)
- Frishammar, J., & Ake Horte, S. (2005). Managing External Information in Manufacturing Firms: The Impact on Innovation Performance\*. *Journal of Product Innovation Management*, 22(3), 251–266. <https://doi.org/10.1111/j.0737-6782.2005.00121.x>
- Haq, Z. U., Rasheed, R., Rashid, A., & Akhter, S. (2023). Criteria for Assessing and Ensuring the Trustworthiness in Qualitative Research. *International Journal of Business Reflections*, 4(2), 150-173. Available at: <http://journals.pu.edu.pk/journals/index.php/ijbr/article/view/7358>
- Haque, I., Rashid, A., & Ahmed, S. Z. (2021). The Role of Automobile Sector in Global Business: Case of Pakistan. *Pakistan Journal of International Affairs*, 4(2), 363-383. <https://doi.org/10.52337/pjia.v4i2.195>
- Hashmi, A. (2022). Factors affecting the supply chain resilience and supply chain performance. *South Asian Journal of Operations and Logistics*, 1(2), 65-85. <https://doi.org/10.57044/SAJOL.2022.1.2.2212>
- 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.  
<https://doi.org/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. <https://doi.org/10.18488/journal.11.2020.93.148.160>
- Hashmi, A. R., Amirah, N. A., & Yusof, Y. (2021b). Organizational performance with disruptive factors and inventory control as a mediator in public healthcare of Punjab, Pakistan. *Management Science Letters*, 11(1), 77-86. <https://doi.org/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. <https://doi.org/10.18488/journal.29.2020.72.247.254>
- Hashmi, A. R., Amirah, N. A., Yusof, Y., & Zaliha, T. N. (2021a). Mediation of inventory control practices in proficiency and organizational performance: State-funded hospital perspective. *Uncertain Supply Chain Management*, 9(1), 89-98. <https://doi.org/10.5267/j.uscm.2020.11.006>
- Hashmi, R. (2023). Business Performance Through Government Policies, Green Purchasing, and Reverse Logistics: Business Performance and Green Supply Chain Practices. *South Asian Journal of Operations and Logistics*, 2(1), 1-10. <https://doi.org/10.57044/SAJOL.2023.2.1.2301>
- Hwang, D., & Min, H. (2015). Identifying the drivers of enterprise resource planning and assessing its impacts on supply chain performances. *Industrial Management & Data Systems*, 115(3), 541-569. <https://doi.org/10.1108/imds-10-2014-0284>
- Jasti, N. V. K., & Kodali, R. (2015). A critical review of lean supply chain management frameworks: proposed framework. *Production Planning & Control*, 26(13), 1051-1068. <https://doi.org/10.1080/09537287.2015.1004563>
- Jaworski, B. J., & Kohli, A. K. (1993). Market Orientation: Antecedents and Consequences. *Journal of Marketing*, 57(3), 53-70. <https://doi.org/10.1177/002224299305700304>
- Jayaram, J., Vickery, S., & Droge, C. (2008). Relationship building, lean strategy and firm performance: an exploratory study in the automotive supplier industry. *International Journal of Production Research*, 46(20), 5633-5649. <https://doi.org/10.1080/00207540701429942>
- Khan, S. K., Ahmed, S., & Rashid, A. (2021). Influence of social media on purchase intention and customer loyalty of generation Y with the mediating effect of conviction: a case of Pakistan. *Pakistan Journal of International Affairs*, 4(2), 526-548. <https://doi.org/10.52337/pjia.v4i2.207>
- Khan, S. K., Rashid, A., Benhamed, A., Rasheed, R., & Huma, Z. (2023b). Effect of leadership styles on employee performance by considering psychological capital as mediator: evidence from airlines industry in emerging economy. *World Journal of Entrepreneurship, Management and Sustainable Development*, 18(6), 799-818. <https://doi.org/10.47556/J.WJEMSD.18.6.2022.7>
- Khan, S., Rasheed, R., Rashid, A., Abbas, Q., & Mahboob, F. (2022). The Effect of Demographic Characteristics on Job Performance: An Empirical Study from Pakistan. *Journal of Asian Finance, Economics and Business*, 9(2), 283-294. <https://doi.org/10.13106/JAFEB.2022.VOL9.NO2.0283>
- Khan, S., Rashid, A., Rasheed, R., & Amirah, N. A. (2023a). Designing a knowledge-based system (KBS) to study consumer purchase intention: the impact of digital influencers in Pakistan. *Kybernetes*, 52(5), 1720-1744. <https://doi.org/10.1108/K-06-2021-0497>
- Lewis, I., & Talalayevsky, A. (2004). Improving the interorganizational supply chain through optimization of information flows. *Journal of Enterprise Information Management*, 17(3),

229–237. <https://doi.org/10.1108/17410390410531470>

- Li, J., Zhang, G., Qi, S., Li, X., & Peng, X. (2006). Concentrations, enantiomeric compositions, and sources of HCH, DDT and chlordane in soils from the Pearl River Delta, South China. *Science of the Total Environment*, 372(1), 215–224. <https://doi.org/10.1016/j.scitotenv.2006.09.023>
- Marodin, G. A., & Saurin, T. A. (2014). Managing barriers to lean production implementation: context matters. *International Journal of Production Research*, 53(13), 3947–3962. <https://doi.org/10.1080/00207543.2014.980454>
- Perez, C., de Castro, R., Simons, D., & Gimenez, G. (2010). Development of lean supply chains: a case study of the Catalan pork sector. *Supply Chain Management: An International Journal*, 15(1), 55–68. <https://doi.org/10.1108/13598541011018120>
- Rasheed, R., & Rashid, R. (2023). Role of service quality factors in word of mouth through student satisfaction. *Kybernetes*, In press. <http://dx.doi.org/10.1108/k-01-2023-0119>
- Rasheed, R., Rashid, A., Amirah, N. A., & Afthanorhan, A. (2023). Quantifying the moderating effect of servant leadership between occupational stress and employee in-role and extra-role performance. *Calitatea*, 24(195), 60-68. <https://doi.org/10.47750/QAS/24.195.08>
- Rashid, A. & Rasheed, R. (2022). A Paradigm for Measuring Sustainable Performance Through Big Data Analytics–Artificial Intelligence in Manufacturing Firms. Available at SSRN 4087758. <https://doi.org/10.2139/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., & Rasheed, R. (2023). Mediation of inventory management in the relationship between knowledge and firm performance. *SAGE Open*, 13(2), 1-11. <https://doi.org/10.1177/21582440231164593>
- Rashid, A., & Rasheed, R. (2024). Logistics Service Quality and Product Satisfaction. *SAGE Open*, In press. <https://doi.org/10.1177/21582440231224250>
- Rashid, A., Ali, S. B., Rasheed, R., Amirah, N. A. & Ngah, A. H. (2022a). A paradigm of blockchain and supply chain performance: a mediated model using structural equation modeling. *Kybernetes*, 52(12), 6163-6178. <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. <https://doi.org/10.18488/journal.29.2020.72.289.294>
- Rashid, A., Rasheed, R., & Amirah, N. A. (2023). Information technology and people involvement in organizational performance through supply chain collaboration. *Journal of Science and Technology Policy Management*, In press. <https://doi.org/10.1108/JSTPM-12-2022-0217>
- Rashid, A., Rasheed, R., & Amirah, N. A., & Afthanorhan, A. (2022b). Disruptive factors and customer satisfaction at chain stores in Karachi, Pakistan. *Journal of Distribution Science*, 20(10), 93-103. <https://doi.org/10.15722/jds.20.10.202210.93>
- Rashid, A., Rasheed, R., & Ngah, A. H. (2024). Achieving Sustainability through Multifaceted Green Functions in Manufacturing. *Journal of Global Operations and Strategic Sourcing*, In press. <https://doi.org/10.1108/JGOSS-06-2023-0054>

- 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. <https://www.tojqi.net/index.php/journal/article/view/6159/4387>
- Schenberg, L. C., & Lovick, T. A. (1995). Attenuation of the midbrain-evoked defense reaction by selective stimulation of medullary raphe neurons in rats. *American Journal of Physiology-Regulatory Integrative and Comparative Physiology*, 269(6), R1378–R1389. <https://doi.org/10.1152/ajpregu.1995.269.6.r1378>
- Shah, R., & Ward, P. T. (2003). Lean manufacturing: context, practice bundles, and performance. *Journal of Operations Management*, 21(2), 129–149. [https://doi.org/10.1016/s0272-6963\(02\)00108-0](https://doi.org/10.1016/s0272-6963(02)00108-0)
- Sharma, A., Kumar, K. S., Singh, A. K., & Siddiqui, N. I. (2021). *Cultivating Effectiveness and Efficiency Using 5S Methodology*. 41–52. [https://doi.org/10.1007/978-3-030-79065-3\\_4](https://doi.org/10.1007/978-3-030-79065-3_4)
- Singhi, S., Grover, S., Bansal, A., & Chopra, K. (2014). Randomised comparison of intravenous magnesium sulphate, terbutaline and aminophylline for children with acute severe asthma. *Acta Paediatrica*, 103(12), 1301–1306. <https://doi.org/10.1111/apa.12780>
- Tangen, S. (2005). Demystifying productivity and performance. *International Journal of Productivity and Performance Management*, 54(1), 34–46. <https://doi.org/10.1108/17410400510571437>