

## DETERMINING BARRIERS IN LEAN MANUFACTURING IMPLEMENTATION AMONG MALAYSIAN SMEs

S. Q. Z. Alam

Quality Engineering Section, Malaysian Institute of Industrial  
Technology, University Kuala Lumpur, Johor, Malaysia.  
sofia.zainal05@s.unikl.edu.my

M. A. Mohd Daril

Quality Engineering Section, Malaysian Institute of Industrial  
Technology, University Kuala Lumpur, Johor, Malaysia.  
mamran@unikl.edu.my

\*Corresponding author's email: [sofia.zainal05@s.unikl.edu.my](mailto:sofia.zainal05@s.unikl.edu.my)  
[mamran@unikl.edu.my](mailto:mamran@unikl.edu.my)

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### ABSTRACT

Lean manufacturing concept able to reduce waste and improve efficiency of companies as there are many companies have implemented this concept and achieved great improvements. All companies must always strive for excellence in order to maintain competitiveness on the market. This study focuses on the lean manufacturing adoption in the Pasir Gudang Small Medium Enterprise (SME). The goal of this research is to identify the barriers of SMEs towards lean manufacturing implementation and to determine the highest ranking of barriers. In addition, the purpose of this research is to develop a measurement model of barriers to the implementation of lean manufacturing in the SMEs context. Methodologically, this research employs quantitative approaches which is questionnaire. The development and distribution of a structured questionnaire to a significant number of Pasir Gudang industrial businesses. The degree of barrier implementation of lean manufacturing in SMEs is evaluated and analysed using SPSS Software which involving Exploratory Factor Analysis, Friedman Test, Normality Test and Reliability test. The results demonstrate that there are 4 constructs that are supported by 35 items that contribute as a barrier to the adoption of lean manufacturing by SMEs. The research's findings also indicate that lack about lean information and understanding ranks top among barriers.

**Keywords:** *Lean Barriers; Lean Manufacturing; Small and Medium Enterprises (SMEs)*

## 1.0 Introduction

With the global market becoming highly competitive, many organizations face enormous pressure to achieve operational excellence and enhance their performance in order to decrease costs and deliver higher-quality goods in shorter lead times. Lean manufacturing concept and methods have been widely implemented by industrial organizations in order to accomplish these goals and obtain a competitive edge over their competitors [1]. Lean manufacturing is a management approach to manufacturing that aims to make companies more competitive in the marketplace by increasing efficiency and reducing costs by eliminating non-value-added steps and inefficiencies in the process [2].

Basically, the concept of lean manufacturing is adopted through Toyota Production System (TPS) [3] however they are completely having a different system and approach. The aims for Toyota Production System are continuous improvement in standard processes and procedure in order to ensure world class quality levels to meet the expectation of 16 customers, as well as to serve as a model of corporate responsibility in the industry and in the surrounding community. While lean manufacturing is aim at eliminating waste from the production process. When waste is eliminated, the quality improves. Thus, this will lead to minimization of cost and production time as the quality improves. Lean manufacturing also targets for perfect value by adding the value to optimize the process flow and ensure a smooth flow of work. From the customer's perspective, value is equivalent to anything that they willing to pay for the product or services. To attain these goals, lean manufacturing focuses primarily on the flow of materials from the moment a material enters the process to the moment a product is ready for the customer [4]. Numerous method and tools that offered by lean manufacturing can be used to improve the operational performance of organization. In particular, [3] consider Just in Time (JIT), Kanban, Poka-Yoke, Value Stream Mapping (VSM), Kaizen and Total Productive Maintenance (TPM) are the most essential tool for lean approach.

The coronavirus COVID-19 pandemic defines the global health crisis that have affected more than hundred million lives in the world. Besides it effects on people's health, Pandemic Covid-19 outbreak has significantly plunged the global economic recession. A striking drop on the entire of the trade and industry business sales recently has become the greatest worry to the nation especially Small and Medium Enterprise (SME) sectors. Small businesses are mostly unaffected by the economic devastation, as their daily activities such as production, distribution, supply chain management, and retailing cannot be carried out [5]. SMEs must consider lean manufacturing adaptations for their new operations and procedures. This is seen in the [6] study, where lean manufacturing enabled companies to boost their productivities by at least 30% and reduce their work time by 50%. Thus, by identifying and overcoming barriers, SMEs may improve and enhance the future success rate and resource efficiency of lean manufacturing.

## 2.0 Literature Review

### 2.1 Information and Understanding about Lean

Information and understanding about lean are crucial considerations since they are critical organizational strategic resources. Lack of information and understanding regarding lean have been identified as barrier faced by SMEs in implementing lean [7]. Lean is derived from the Toyota Production System as a production methodology that employs techniques and tools capable of identifying all the unnecessary activities (waste) in the production of goods and services, thereby making people and the production processes more efficient and effective, reducing costs, and generating value to the customer [8]. Implementation of lean tools such as 5S, Kanban system and visual management is the most common tools that have been utilized by SMEs however the result also indicates there are some workers are still lack of knowledge regarding lean tools and does not concern with these tools [8]. Additionally, [7] concluded that as SMEs' awareness of lean is enhanced, they are able to make more effective use of their resources thereby contributing to the circular economy at the company level. According [9], instead of merely selecting and using lean tools developed elsewhere, a thorough understanding of the underlying principles is required for successful lean deployment.

[10] as cited in [6] discovered a misunderstanding of the lean concept wherein SMEs found it difficult to estimate demand patterns for specific assortment groups. The inconsistency between historical sales data and current market conditions has made it impossible to maintain the production line's efficiency. This differs from the lean concept, which dictates that a company should align production volume to sales volume. Many authors have pointed out that lack of understanding of lean benefits is considered as lean barrier [11]. This is due to the fact that to management does not convince their employees of the benefits of lean manufacturing, despite the fact that it improves efficiency, reduces waste, and increases productivity. Lack of implementation know-how has been cited in [12] where the workers have insufficient practical knowledge to execute lean, despite understanding the idea. Improper selection of lean tools and practices is considered as tactical issue in lean barrier by [13] that must be addressed by middle-level managers in order to ensure the overall success of lean implementation.

### 2.2 Strategy and Planning

Strategic planning is the process by which the leaders of an organization create its vision for the future and identify its goals and objectives. The process includes determining the sequence in which these objectives must be attained for the organization to realize its stated vision [14]. One of the characteristics that lead to lean accomplishments is a defined, well-communicated strategy. Frequent changes in an improvement strategy hinder the growth of potentially successful lean implementation plans [9]. Failure of lean implementation is due to the lack of clear vision and planning [6]. Without a proper planning, it is hard to achieve the vision as planned thus the organization may set up a monitoring committee to realize their vision and accomplish it. Lean planning is vital for a controlled and structured change approach, as it provides an accurate perspective of the selected lean practices, including estimated costs, and the anticipated duration of lean implementation.

Furthermore, [13] claimed that the inability to build a cross-functional team ability to integrate the various functionalities of a lean implementation was highlighted as one of the most significant lean obstacles. A multiskilled workforce is required for a cross-functional team tasked with performing a variety of tasks. Forming a group of multiskilled workers requires proper training. Proper training equips employees with the skills necessary for the successful

implementation of lean. Moreover, failure of previous improvement projects also could lead to lean implementation barrier as they have a bad experience, thus impact the motivation of the employee and generate disinterest [15]. [16] argued that the inability to prioritize lean tools and practices is related to employees' lack of interest in lean knowledge, tools, and practices. Thus, the tools and methods are not selected in accordance with best practice.

### **2.3 Resource Management**

The practice of planning, scheduling, and assigning people, money, and technology to a project or programme called resource management. Essentially, it is the process of allocating resources to maximize organizational value. Good resource management results in the availability of the right resources at the right time for the right tasks [17]. According to [18], if the management decides to implement lean, the resources must be easily accessible and utilized effectively. This is due to the extensive engagement of people, facilities, systems, processes, and money. Few organizations struggle to implement lean due to a lack of time for training or money and resources to invest in a lean project. Cost and time associated with lean implementation are a factor that hinders the progress of lean implementation [9]. For instance, small company required big investment to change their traditional layout to a modern cellular layout to have a better process flow. Financial resources was not the only constraint but human resources in terms of their skill and knowledge were also a big constrain in lean implementation as claimed by [19]. In order for a successful lean practice implementation, it is imperative for the management to make resources available for the execution especially technological infrastructure in order to maximize production capacity. Lean implementation was severely hindered by a lack of adequate technology infrastructure, especially to have an effective communication. Technological infrastructure provides a solid foundation for the lean implementation process by scientifically and objectively utilizing knowledge [13].

Besides, a valid lean performance measuring system was required to help managers make logical decisions based on a particular level of objectivity. Because of the subjectivity involved, most real-world events are vague. Implementing a lean system is a type of business process reengineering that necessitates a flexing organization, a flexible production system, and flexible people. Absence of valid lean performance measurement system may affect decision making process for top management. Hence, it is important for the management to ensure adequate facilities in terms of technology, financial and skilled worker for the smooth implementation of lean manufacturing

### **2.4 Human Attitude and Culture**

An attitude is a person's tendency to react to an object, activity, person, institution, or event with a given degree of favorability or unfavourability [20]. In this context, human attitude that unfavorable with the implementation of lean manufacturing. A company's culture can be described as a set of rules and behaviors that encompass trust, hierarchy, working environment, and comradery [19]. The organizational culture of a SMEs reflects the personality or attitude of its top executives. Hence, lean manufacturing cannot be implemented in the organization of their workers do not want to change how they do their works. The organizational culture such as highly respect to work environment, employee's relationship and trust are vital determinant for successful lean implementation. Transformation of businesses toward Lean should be synergistically oriented on making technical and organizational changes, but ultimately on developing an internal culture. [10] mentioned that the deployment of lean management is

frequently met with resistance from employees. Worry of change and fear of layoffs as a result of implemented changes may be the primary reasons of it.

The difficulties encountered with implementing lean are related to the problem of people refusing to change and reverting to their previous inefficient methods of work as they feel lean tools is difficult to implement and practices [12]. This statement also supported by [21] where when obstacles are faced, the tendency to revert to traditional practices is the main barrier to lean implementation. In their case 38 studies also found that supervisors and employees clung to their old practices and did not adopt the new ways proposed by consultants. Additionally, technology plays a major role in making a system more responsive but fear in adopting new technology would be a barrier of lean implantation [11]. SMEs' top management is skeptical about the future of new technologies and so reluctant to adopt them. Also, in this era of fast evolving technologies, SMEs management worry constant technological upgrades. [22] stated that fear is a fundamental barrier to lean manufacturing implementation in any company. SMEs' management tends to see new technology adoption as an expense rather than a strategic investment. They also believe that new technology may not fit, be required, or be cost effective. They also fear that implementing the new technology may diminish their productivity.

Apart from that, lean is not a daily focus among the workers as the management does not allocate necessary time required for lean activities [16]. Furthermore, the worker is preoccupied with their "day jobs." Due to a deficiency of labor, they have no time to implement lean practices. This will unintentionally result in worker frustration in the face of unsatisfactory performance. According to [15], it is a critical barrier for lean adoption to be able to disseminate the mindset of continuous improvement to all employees and integrate it into their daily routine. This may due to the lack of skilled and committed leaders who follow the underlying principles. Hence, based on past studies, managers and practitioners should focus on leadership and organizational culture as the major barrier for lean implementation.

## **2.5 Employee Empowerment and Involvement**

Employee empowerment can be defined as the process of creating a work environment in which employees can actively engage in the decision making, problem-solving, and goal-setting processes. It entails the delegation of decision-making authority to employees [23]. On the other hand, employee involvement is a process that connects participation, communication, and decision-making, resulting in industrial democracy and employee motivation [24]. He emphasized that employee participation in an organization's operations encourages and helps them to contribute effectively and successfully to the organization's success. A company's employees are the ones who are qualified to use their professional knowledge, skills, and expertise to help the company grow. In order to ensure successful lean implementation, it is critical to include experts from each department in the process of building a value stream map throughout the lean implementation phase and to empower them to practice what they preach [25] as cited in [9]. Consequently, every employee must be educated on the organization's strategy, understand its function, and set personal goals with defined deadlines.

Furthermore, lack of communication is kind of barrier exist in any [21]. He emphasized that for all management initiatives, including lean, effective communication across all levels of the organizational structure and between internal and external stakeholders is essential. It functions as mortar between brickwork. The most important success factor for a lean implementation is effective communication within the organization and amongst its



stakeholder. Employees must be provided with information of the changes being made. The discontinuation of the lean project was attributed by the lack of team autonomy and organizational communication [26]. Involvement of employees is essential to achieving continual improvement in the industrial sector. Involvement of employees is also crucial to ensuring that the lean implementation process leads to improvements in work practices. When the employee participates in the decision-making process, it is easier for them to accept changes. However, lack of employee involvement has been discovered as lean implementation barrier [16].

Teamwork is considered as important characteristics in lean manufacturing. Responsibilities must be decentralized onto the multifunctional teams thus the multifunctional team is expected to perform supervisory duties in a lean production system. In its most complex form, this is accomplished by rotating team leadership among specifically qualified staff. As a result, the number of organizational hierarchical levels can be minimized [27]. Quality circles are frequently utilized to involve everyone in the process of improvement. These are exercises in which groups of operators come up with suggestions for potential improvements. This is related to an intricate plan for adopting proposals, compensating personnel, and providing feedback on the suggestions' status. Therefore, this able to enhance the teamwork and boost their motivation in performing tasks. In spite of that, lack of motivation and teamwork have been mentioned in [16] research.

## **2.6 Top Management Commitment and Leadership**

Top Management Commitment entails the direct participation of the highest-level management in all specific and crucially important issues, such as safety, quality, environment, security, and programmes of an organization and others [28]. Besides, he also mentioned that the concept of leadership is the ability of top management to build a process and strategic vision for the organization that is concentrated on meeting customer requirements. Lack of commitment from top management have been cited in numerous researches as a massive barrier in lean implementation [26]. Top Management commitment is a crucial component in order to ensure the success of any new initiative to be successful. Lack of managerial commitment results in a swarm of additional issues, including restricted access to resources, delays in decision-making processes, and ineffective communication [21]. Lean implementation demands the ongoing participation, encouragement, and supervision of top management. To maintain the project, upper-level management must provide a vision, strategy, objectives, and direction [29]. This aspect is especially essential in the context of small and medium-sized enterprises due to the direct involvement of top management in routine operations, direct monitoring, and deliveries.

Besides lack of top management commitment, poor leadership also have been discovered as lean implementation barrier [22]. He also opined that to successfully adopt lean manufacturing practices in SMEs, it is vital to hire strong leaders, who are capable of integrating all the assets to boost production. Top management with strong leadership has the vision and strategy to create value for their company. Additionally, strong leadership contributes to the development of the employees' skill sets [16]. Leadership is very important at all levels of management. Personal objectives will be incorporated and reconciled with organizational objectives by a leader.

## 2.7 Management Responsibility and Roles

Management responsibility entails being responsible for the overall management of a work unit and its output, operational policies or procedures, efficiency and quality of work output. Management responsibility play an important role if an organization wanted to achieve a successful lean manufacturing implementation. Based on [18], management support and involvement help the most to achieving an outstanding performance. Moreover, this is reinforced by [30] who describe management engagement and commitment as one of the essential factors for applying lean technique in the manufacturing and service industries of the United Kingdom. Apart from that, trained and skill people are regarded as an industry assert. For the successful adoption of lean, managers and employees must get extensive training to enhance their lean knowledge. In the case of SMEs, a lack of training and skills was identified as one of the causes for the low degree of lean implementation. Due to financial and time restriction, some SMEs decided to avoid some training programmes [21]. [31] stated that one of the most critical triggers in unsuccessful lean programs is the lack of technical knowledge and education thus causes the employee could not deliver their tasks properly. Lack of expertise on lean is due to inadequate knowledge about the lean in employees resulting in confusion on the program and not fully acknowledging the benefits. This ultimately contributes to employee resistance because they are not included in the planning and implementation phases of leanness [31].

Furthermore, work force flexibility emphasizes the willingness and ability to adapt to change, particularly regarding how and when work gets done. In a flexible workplace, the needs of both employee and employer are met. Flexibility in the workplace is commonly employed as a retention and engagement tactic. However, [13] discovered that inflexible work force is one of the lean barriers and this led to the workers to have a hard time adjusting to changes they do not like, tends to reject ideas that go against their own preferences, and prefers to maintain their own way of doing things. Besides, the first step in lean planning is identifying the roles and responsibilities of lean implementation. The majority of lean implementations fail because to ambiguity and confusion caused by poorly defined roles and responsibilities [13]. According to [32], lack of knowledge about existing specialist also considered as lean barrier this is due to the difficult to find out a skilled person in some area and other SMEs are ready to offer more salary to employee that have expertise in lean. In lean, better collaboration is needed from the customer to understand their needs and to address their issues on time in an effective way. In order to achieve long-term success, a positive working connection between the company and its customers, vendors, and other stakeholders is a [33]. Despite this, lack of customer focus as one of the barriers to lean implementation [13].

## 3.0 Methodology

This study employed a quantitative methodology involving the distribution of survey questionnaires. Quantifying this research required a total of 201 respondents. According to the Krejcie Morgan table, where there are 420 populations, a total of 201 respondents were necessary to be distributed to the target population.

The number of respondents in this survey is 109, although the actual population sample determined by the previous Krejcie Morgan table is 201. [34] argued that a survey requires a minimum sample size of 100. Thus, it may be inferred that the response rate for this survey is sufficient, and that further analysis can be conducted. Several data analysis methods, including interdependence method multivariate analysis using Exploratory Factor Analysis (EFA), KMO

& Bartlett's Test of Sphericity, and Friedman test (mean ranking analysis), were applied to analyse the data gathered from the questionnaire.

#### 4.0 Result and Discussion

##### 4.1 To identify the barriers of SMEs towards lean manufacturing implementation.

There are 35 barriers that influence the SMEs to implement lean manufacturing which the information acquired through journal and articles. All the factors found was categorized into the suitable construct. Seven main construct of barriers was developed throughout this study.

Table 4.1 Barriers in SMEs Lean Manufacturing Implementation

No.	Variables	Factors
<b>Construct 1: Information and Understanding about Lean</b>	IUL1	Lack of knowledge of lean principle
	IUL2	Difficulty in understanding some lean tools
	IUL3	Misunderstanding of Lean Manufacturing concept
	IUL4	Lack of understanding of lean benefits
	IUL5	Lack of implementation know-how
	IUL6	Improper selection of lean tools and practices
<b>Construct 2: Strategy and Planning</b>	SP1	Lack of planning
	SP2	Lack of strategic perspective
	SP3	Absence of cross functional team
	SP4	Failure of previous improvement projects
	SP5	Failure to prioritize lean tools and practices
<b>Construct 3: Resource Management</b>	M1	Limited resources
	M2	Lack of time
	M3	Lack of capital fund
	M4	Insufficient technology infrastructure
	M5	Absence of valid lean performance measurement system
<b>Construct 4: Human Attitude and Culture</b>	HAC1	Resistance to change
	HAC2	Organizational culture
	HAC3	Lean is difficult to implement
	HAC4	Fear in adopting new technology
	HAC5	Difficulty of adapting improvement projects



	HAC6	Back sliding to old methods
	HAC7	Lean not a daily focus
<b>Construct 5: Employee Empowerment and Involvement</b>	EEI1	Lack of communication
	EEI2	Lack of teamwork
	EEI3	Lack of motivation
	EEI4	Lack of employee's involvement
<b>Construct 6: Top Management Commitment and Leadership</b>	TMCL1	Poor leadership
	TMCL2	Lack of commitment from top management
<b>Construct 7: Management Responsibility and Roles</b>	MRR1	Lack of training and skill
	MRR2	Lack of expertise on lean
	MRR3	Inflexible workforce
	MRR4	Poorly defined role and responsibility
	MRR5	Lack of knowledge about existing specialist
	MRR6	Lack of customer focus

#### 4.2 To determine the highest ranking of barriers in SMEs towards lean manufacturing implementation.

Friedman test (mean ranking analysis) was used to identify the most significant barriers in Lean Manufacturing implementation among Pasir Gudang SMEs.

Table 4.2 Friedman Test Ranks

<b>Ranks</b>	
	Mean Rank
Information and Understanding about Lean	2.69
Management Responsibilities	2.56
Human Attitude and Culture	2.48
Strategy and Planning	2.26

Table 4.3 Friedman Test Statistics

Test Statistics <sup>a</sup>	
N	94
Chi-Square	14.316
df	3
Asymp. Sig.	.003

From the table above, a Friedman test was executed to determine which factor had the most impact on the company's implementation of lean manufacturing. As demonstrated in table, the highest ranking or factor that influences the company's implementation of lean manufacturing is the company's grasp of lean with a mean of 2.69. In addition, respondents concurred that strategy and planning has the least impact on lean manufacturing adoption, since the mean has the lowest rank in the Friedman test. With a p-value of 0.003, which is less than 0.05, the Friedman test reveals that there were substantially higher favorable rankings of information and understanding regarding lean over other factors. Consequently, the finding was proved to be significant.

#### 4.3 To develop a measurement model of barriers in lean manufacturing implementation among SMEs.

Based on the findings at Table 4.1, the interdependence approach multivariate analysis with Exploratory Factor Analysis (EFA) was utilised to construct a model of barriers to the implementation of lean manufacturing among Pasir Gudang SMEs. Prior to EFA, the KMO & Bartlett's Test was used to evaluate the adequacy of the sample. According to table 4.4, Kaiser-Mayer-Olkin has a greater value than 0.5. Thus, demonstrate that the sample is adequate. In addition, this measure of sample adequacy suggests that a proportion of variability in variables are due to underlying factors, hence enabling the use of factor analysis. This is supported by the Bartlett's sphericity test value of 0.001, which is less than 0.05. It demonstrates that the analysis is significant.

Table 4.4 KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.926
Bartlett's Test of Sphericity	Approx. Chi-Square	5072.910
	df	595
	Sig.	<.001

Rotated factor with Varimax Rotation as shown in Table 4.5 was used to analyses the factor of the barriers in Lean Manufacturing implementation among Pasir Gudang SMEs.

Table 4.5 Exploratory Factor Analysis with Varimax Rotation

Rotated Component Matrix <sup>a</sup>				
	Component			
	1	2	3	4
IUL1				.693
IUL2				.637
IUL3				.754
IUL4				.811
IUL5	.540			.557
IUL6	.518			.583
SP1			.571	
SP2			.547	
SP3			.618	
SP4			.663	
SP5	.505		.550	
M1	.687			
M2	.579	.551		
M3	.700			
M4	.723			
M5	.649			
HAC1		.565		
HAC2		.655		
HAC3		.743		
HAC4		.574		
HAC5		.618		
HAC6	.616	.503		
HAC7		.744		
EEI1	.521		.523	
EEI2	.734			
EEI3	.586		.566	
EEI4	.564		.519	
MRR1	.727			
MRR2	.781			
MRR3	.539			
MRR4	.599			
MRR5	.761			
MRR6	.681			
TMCL1	.504		.641	
TMCL2	.508		.643	

The researcher used factor analysis to attempt to reconstruct the four factors using principal component analysis and varimax rotation. Table 4.5 displayed the statistics. In order to achieve a sufficient level of convergent validity, according to Abdi (2014), the values for factor should be greater than 0.5. Based on Table 4.5, it can be seen that the total value of all the factors is more than 0.5. In addition, there were 35 items that are still remains with no deletion. In earlier findings, the researcher had considered there to be seven constructs however the analysis has revealed that there are just four.

The first factor can be categorized as Management Responsibilities. This factor consists of fifteen items namely limited resources, lack of time, lack of capital fund, insufficient technology infrastructure, absence of valid lean performance measurement system, back sliding to old methods, lack of teamwork, lack of motivation, lack of employee's involvement, lack of training and skill, lack of expertise on lean, inflexible workforce, poorly defined role and responsibility, lack of knowledge about existing specialist and the last item is lack of customer focus.

Human Attitude and Culture might be classified as the second factor. This factor is comprised of six components that have remained from previous study. These includes resistance to change, organizational culture, lean is difficult to implement, fear in adopting new technology and lean not a daily focus.

Next, Strategy and Planning can be classified as the third factor. This factor includes eight items that are lack of planning, lack of strategic perspective, absence of cross functional team, failure of previous improvement projects, failure to prioritize lean tools and practices, lack of communication, poor leadership and lack of commitment from top management.

The final factor can be described as Information and Understanding about Lean. All the items are also remnants of the researcher's preliminary study, whereby the items are lack of knowledge of lean principle, difficulty in understanding some lean tools, misunderstanding of lean manufacturing concept, lack of understanding of lean benefits, lack of implementation know-how and improper selection of lean tools and practices.

These are the correct constructs that need to be reconstructed and gathered into one, as indicated by exploratory factor analysis. The selected items will be placed in the group of constructs described in the previous research, and for those items that must choose between two constructs, the researcher must select the one with the greater value.

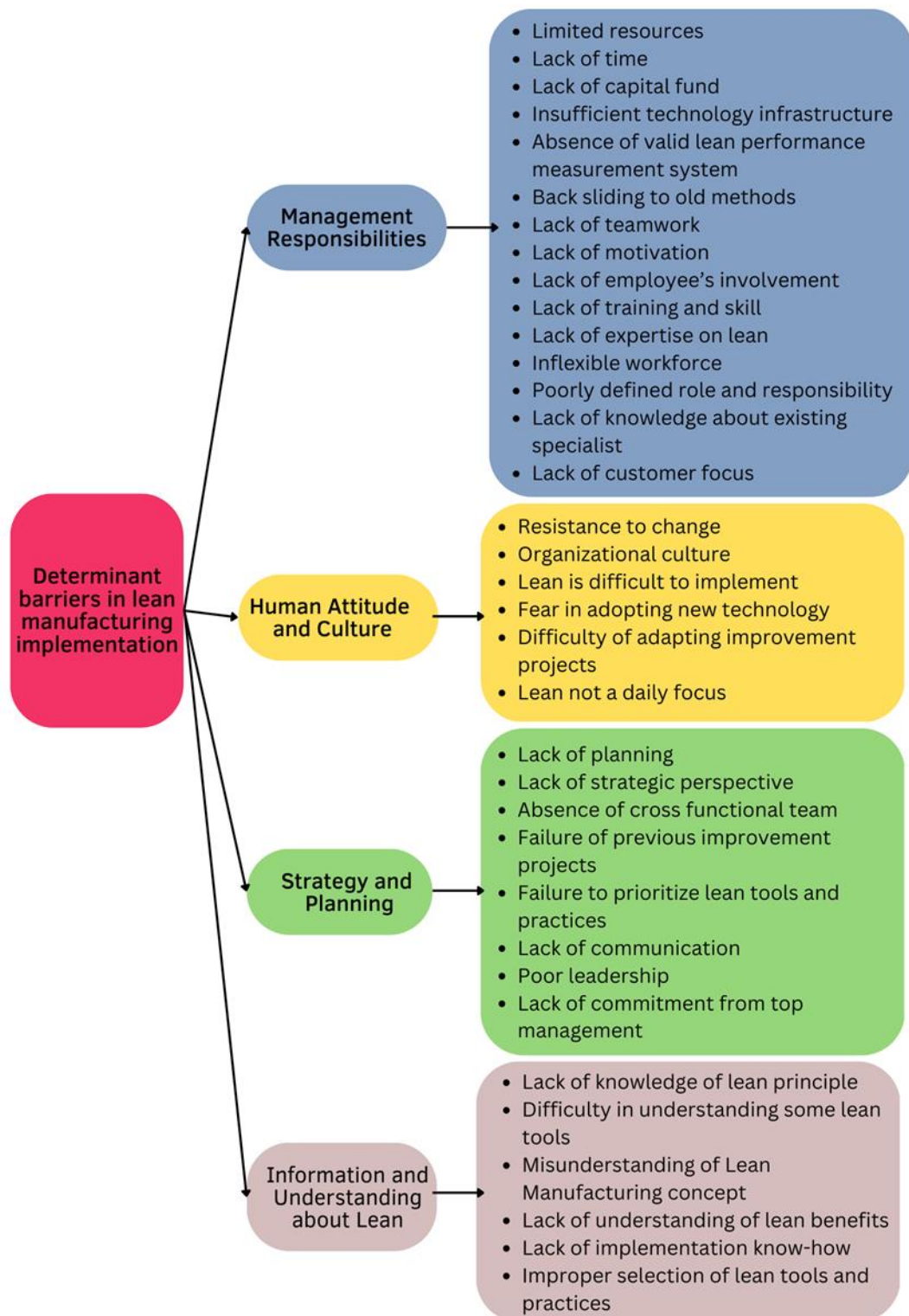


Figure 4.1 New Measurement Model for Determinant Barriers in Lean Manufacturing Implementation

#### 4.0 Conclusion

All the constructs and items based on the researcher assumption were reduced and reconstructed using Exploratory Factor Analysis (EFA) analysis, and then a new conceptual model framework was established. In this study, the factor loading all above than 0.5 thus there is no factors will be omitted. The barriers in Lean Manufacturing Implementation among Pasir Gudang SMEs are consisting of 35 barriers that loading into 4 main factors.

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#### 6.0 References

- [1] I. Belekoukias, J. A. Garza-Reyes, and V. Kumar, "The impact of lean methods and tools on the operational performance of manufacturing organisations," *Int. J. Prod. Res.*, vol. 52, no. 18, pp. 5346–5366, 2014, doi: 10.1080/00207543.2014.903348.
- [2] D. Garza-Reyes, J.A., Oraifige, I., Soriano-Meier, H., Forrester, P.L. and Harmanto, "The development of a lean park homes production process using process flow and simulation methods," *J. Manuf. Technol. Manag.*, vol. 23, no. 2, pp. 178–197, 2012.
- [3] L. S. Valamede and A. C. S. Akkari, "Lean 4.0: A new holistic approach for the integration of lean manufacturing tools and digital technologies," *Int. J. Math. Eng. Manag. Sci.*, vol. 5, no. 5, pp. 854–868, 2020, doi: 10.33889/IJMEMS.2020.5.5.066.
- [4] M. T. M. Ramadan, "RFID-Enabled Dynamic Value Stream Mapping for Smart Real-Time Lean-Based Manufacturing System," p. 181, 2016, [Online]. Available: <http://duepublico.uni-duisburg-essen.de/servlets/DocumentServlet?id=40694>.
- [5] Dato' Abdul Rauf Rashid, "COVID-19: Business impact survey," *Pap. Aus Osterr.*, vol. 8, no. 7–1 June 2020, p. 12, 2020, [Online]. Available: [https://www.ey.com/en\\_my/take-5-business-alert/covid-19-impact-on-malaysian-businesses](https://www.ey.com/en_my/take-5-business-alert/covid-19-impact-on-malaysian-businesses).
- [6] A. Elkhairi, F. Fedouaki, and S. El Alami, "Barriers and critical success factors for implementing lean manufacturing in SMEs," *IFAC-PapersOnLine*, vol. 52, no. 13, pp. 565–570, 2019, doi: 10.1016/j.ifacol.2019.11.303.
- [7] H. T. S. Caldera, C. Desha, and L. Dawes, "Evaluating the enablers and barriers for successful implementation of sustainable business practice in 'lean' SMEs," *J. Clean. Prod.*, vol. 218, pp. 575–590, 2019, doi: 10.1016/j.jclepro.2019.01.239.
- [8] F. W. S. Da Silva, A. C. Alves, and M. C. B. Figueiredo, "Lean production in small and medium sized companies from the free economic zone of Manaus: A reality or just fiction?," *Gest. e Prod.*, vol. 26, no. 4, pp. 1–14, 2019, doi: 10.1590/0104-530X-4237-19.
- [9] M. D. M. Amran, F. Januddi, S. Nuraina, A. W. M. Ikbar, and S. Khairanum, "The barriers in lean healthcare implementation," *Test Eng. Manag.*, vol. 82, no. 1–2, pp.



- 1972–1981, 2020.
- [10] D. Kleszcz, “Barriers and opportunities in implementation of Lean Manufacturing tools in the ceramic industry,” *Prod. Eng. Arch.*, vol. 19, no. 19, pp. 48–52, 2018, doi: 10.30657/pea.2018.19.10.
- [11] A. P. C. Linda Zhang, Balkrishna Eknath Narkhede, “Evaluating Lean Manufacturing Barriers: an inrepretive process,” *J. Manuf. Technol. Manag.*, pp. 1–5, 2017, doi: <https://doi.org/10.1108/JMTM-04-2017-0071>.
- [12] F. Abu, H. Gholami, M. Z. Mat Saman, N. Zakuan, and D. Streimikiene, “The implementation of lean manufacturing in the furniture industry: A review and analysis on the motives, barriers, challenges, and the applications,” *J. Clean. Prod.*, vol. 234, pp. 660–680, 2019, doi: 10.1016/j.jclepro.2019.06.279.
- [13] R. K. Tiwari and J. K. Tiwari, “Prioritization of barriers to lean implementation in indian automotive small & medium sized enterprises,” *Manag. Prod. Eng. Rev.*, vol. 9, no. 2, pp. 69–79, 2018, doi: 10.24425/119526.
- [14] S. J. Bigelow, “What is Strategic Planning? Definition and Steps,” *TechTarget*, 2017. <https://www.techtarget.com/searchcio/definition/strategic-planning> (accessed May 09, 2022).
- [15] L. G. Pereira and G. L. Tortorella, “A Literature Review on Lean Manufacturing in Small Manufacturing Companies,” pp. 69–89, 2018, doi: 10.1007/978-3-319-73648-8\_3.
- [16] E. Lodgaard, J. A. Ingvaldsen, I. Gamme, and S. Aschehoug, “Barriers to Lean Implementation: Perceptions of Top Managers, Middle Managers and Workers,” *Procedia CIRP*, vol. 57, pp. 595–600, 2016, doi: 10.1016/j.procir.2016.11.103.
- [17] J. T. Mahoney, “The management of resources and the resource of management,” *J. Bus. Res.*, vol. 33, no. 2, pp. 91–101, 1995, doi: 10.1016/0148-2963(94)00060-R.
- [18] N. A. M. Fikiray, “A Study of Critical Success Factor of Improvement Methodology in Pasir Gudang Industrial Area,” Universiti Kuala Lumpur, 2019.
- [19] M. Dora, M. Kumar, and X. Gellynck, “Determinants and barriers to lean implementation in food-processing SMEs - A multiple case analysis,” *Prod. Plan. Control*, vol. 27, no. 1, pp. 1–23, 2015, doi: 10.1080/09537287.2015.1050477.
- [20] I. Ajzen, “Attitude theory and the attitude-behavior relation,” *New Dir. Attitude Meas.*, no. August, pp. 41–57, 1993.
- [21] V. Yadav, R. Jain, M. L. Mittal, A. Panwar, and M. K. Sharma, “An appraisal on barriers to implement lean in SMEs,” *J. Manuf. Technol. Manag.*, vol. 30, no. 1, pp. 195–212, 2019, doi: 10.1108/JMTM-12-2017-0262.
- [22] P. Jaiswal, A. Singh, S. C. Misra, and A. Kumar, “Barriers in implementing lean manufacturing in Indian SMEs: a multi-criteria decision-making approach,” *J. Model. Manag.*, vol. 16, no. 1, pp. 339–356, 2021, doi: 10.1108/JM2-12-2019-0276.
- [23] E. Tanjeen, “Employee Empowerment: A Critical Review,” *Dhaka Univ. J. Manag.*, vol. 5, no. 1, 2021, [Online]. Available: <https://www.researchgate.net/publication/343135373>.
- [24] O.; Obiekwe, I.; Zeb-Obipi, and H. Ejo-Orusa, “Employee Involvement in Organizations: Benefits, Challenges and Implications,” *Manag. Hum. Resour. Res. J.*, vol. 8, no. 8, pp. 3363–7036, 2019.
- [25] E. Drotz and B. Poksinska, “Lean in healthcare from employees’ perspectives,” *J. Heal. Organ. Manag.*, vol. 28, no. 2, pp. 177–195, 2014, doi: 10.1108/JHOM-03-2013-0066.
- [26] Jagdish R. Jadhav, Shankar S. Mantha, and Santosh B. Rane, “Exploring barriers in lean implementation,” *Int. J. Lean Six Sigma*, vol. 5, no. Unit 02, pp. 122–148, 2014, [Online]. Available: <http://dx.doi.org/10.1108/IJLSS-12-2012-0014>.
- [27] C. Karlsson and P. Hlström, “Assessing changes towards lean production,” *Int. J. Oper.*

- Prod. Manag.*, vol. 16, no. 2, pp. 24–41, 2016, doi: 10.1108/01443579610109820.
- [28] O. D. Olusanjo, “Top Management Commitment to Total Quality Management as A Correlate of Customer Satisfaction in the Nigerian Banking Sector,” *Texila Int. J. Manag.*, no. April, pp. 35–45, 2019, doi: 10.21522/tijmg.2015.se.19.01.art004.
- [29] A. Abolhassani, K. Layfield, and B. Gopalakrishnan, “Lean and US manufacturing industry: popularity of practices and implementation barriers,” *Int. J. Product. Perform. Manag.*, vol. 65, no. 7, pp. 875–897, 2016, doi: 10.1108/IJPPM-10-2014-0157.
- [30] K. J. Fryer, J. Antony, and A. Douglas, “Critical success factors of continuous improvement in the public sector: A literature review and some key findings,” *TQM Mag.*, vol. 19, no. 5, pp. 497–517, 2007, doi: 10.1108/09544780710817900.
- [31] B. H. Moradlou and T. Perera, “Identification of the Barriers in Implementation of Lean Principles in Iranian SMEs: Case Study Approach,” *Glob. J. Manag. Bus. Res.*, vol. 17, no. 1, pp. 33–41, 2017, [Online]. Available: <http://shura.shu.ac.uk/16266/>.
- [32] J. Ramadas, T; Satish, K.P.; Heap, “Identification and Modeling of Employee Barriers-Implementing Lean Manufacturing in Small and Medium Scale Enterprises Abstract,” 2018.
- [33] B. E. Narkhede, R. D. Raut, M. Roy, V. S. Yadav, and B. Gardas, “Implementation barriers to lean-agile manufacturing systems for original equipment manufacturers: an integrated decision-making approach,” *Int. J. Adv. Manuf. Technol.*, vol. 108, no. 9–10, pp. 3193–3206, 2020, doi: 10.1007/s00170-020-05486-5.
- [34] A. C. Weide and A. Beauducel, “Varimax rotation based on gradient projection is a feasible alternative to SPSS,” *Front. Psychol.*, vol. 10, no. MAR, pp. 1–14, 2019, doi: 10.3389/fpsyg.2019.00645.