



## A Pilot Study on Lean Practice Implementation according to the Sizes and Ages of the Companies

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### Abstract

The purpose of this paper is to address the accompanying lean manufacturing implementation barrier in terms of the sizes and ages of the companies. The 148 wood and furniture companies in Kuala Lumpur and Selangor were selected for the pilot research determinations. Smaller companies account for slightly more than 80% of newly founded and expanding wood and furniture industries, with 60% implementing lean practices. The practical implications indicate that the Malaysian furniture sector will have a promising future, with the number of medium-sized plants anticipated to increase in the upcoming years due to the increase in new and emerging businesses.

Keywords: Lean manufacturing; Lean implementation; Lean practices; Barriers

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### 1.0 Introduction

Malaysia's wood-based industry has been one of the major revenue contributors to the country's economic growth over the past two decades. Malaysian exports of wood and wood products are expected to reach RM22 billion in 2020 (approximately 5.3 billion US dollars). Wooden furniture accounted for 48.3% of the total, while plywood accounted for 12.9% (Malaysia-Investment-Development-Authority, 2020). There are approximately 240,000 workers in this industry, with the biggest furniture hub located in Muar, Johor. Generally, wood and furniture companies in Malaysia are categorised as small to medium-sized enterprises (SMEs), which have 5 to 75 employees (National-SME-Development-Council, 2013). Despite the industry's growth, the adoption of lean manufacturing (LM) practices in Malaysian wood and furniture companies remains a formidable challenge.

LM is a way to improve manufacturing method efficiency and eliminate waste to maximise user value with minimal resources, time, and money (Jum'a et al., 2023; Psomas et al., 2023). Over the past 30 years, LM research has evolved, offering insights applicable to various business sectors. Scholars from a variety of research fields have tried to explain the motives, barriers, challenges, and applications of LM (Abu et al., 2019). By investigating the relationships between culture and human attitude, knowledge, and resource barriers, Abu et al. (2021b) proposed several activities for LM implementation so that SMEs can experience and quantify the positive impacts of lean practices. However, to date, the adoption of LM remains unpromising; hence, persuading the wood and furniture companies to adopt LM is challenging (Abu et al., 2021a; Minh, 2023).

Most of the SMEs were unsuccessful because they were unable to address the accompanying issues (Ali et al., 2019) and barriers (Kaswan et al., 2023; Kunnen et al., 2023). With businesses closing, disruptions in the supply of wood raw materials as a result of the COVID-19 pandemic, globalisation of sustainability issues, and a fiercely competitive environment (Hamed Gholami et al., 2018), lean and fourth industrial revolution (IR 4.0) transformations are likely to become even more important. Therefore, it is crucial to (i) identify

the most suitable and beneficial LM practices for the companies and (ii) analyse the effects of contextual factors (company size and ownership) on LM implementation.

## 2.0 Literature Review

### 2.1 LM practices

A survey study was conducted by four researchers to determine the most beneficial and least difficult LM practices. They used a scale of most to least used LM practices to conduct a frequency ranking position. The ease of use of the LM practices from different research backgrounds is presented in Figure 1. Each ranking consists of 14 to 20 lean practices. Firstly, the use of LM practices among secondary wood manufacturers from the Wood Component Manufacturing Association (WCMA) in the United States (U.S.). The relationship between the size of the companies and the level of improvement was then examined. Kaizen was one of the top five most widely used LM practices in the wood industry, but it came in last place among businesses that used LM practices the least. Panwar et al. (2015) indicated that LM practices such as 5S, total productive maintenance (TPM), and continuous improvement do not require much investment in terms of time or money. They are easy to use because these tools are not industry-specific and do not necessitate small-batch production. Nonetheless, they contribute significantly to waste reduction and quality control. The authors ranked the LM practices to correlate the most important LM practices with the size of the company and the level of LM awareness in Indian process industries. During the lean transformation, new businesses were advised to start with 5S, TPM, and visual control.

Thirdly, surveyed Lithuanian companies that had implemented LM to identify the most popular LM practices used. According to the authors, the companies frequently implement employee training, quality control integration into work procedures, Gemba, and the 5S based on the ranking of usage. This is because, by doing so, they can increase operational performance associated with leanness, i.e., increased efficiency, on-time delivery of orders and services, and decreased unnecessary movements and ineffectiveness. Abolhassani et al. (2016) identified waste elimination as the most valuable and easy-to-use LM practice. The authors looked at how LM practices were implemented in different facility sizes and for different lengths of time in Pennsylvania and West Virginia, as well as the challenges that came with implementing those practices. From the findings, reduced setup time was listed as the most difficult LM practice to be implemented. Companies that have been using LM for 11 to 15 years applied the practice. Moreover, the results showed that 82% of the top management has fundamental insights about LM and that 67% actively practices LM as part of the ongoing improvement programme. Overall, studies performed by Panwar et al. (2015), and Abolhassani et al. (2016) used company size as a factor to measure the success of LM implementation. In addition, it is interesting to examine the influence of company ownership from the perspective of Malaysian society. Moreover, Marodin et al. (2016) suggested that contextual factors can be tested as mediators if there is empirical evidence of their effect on LM practices.

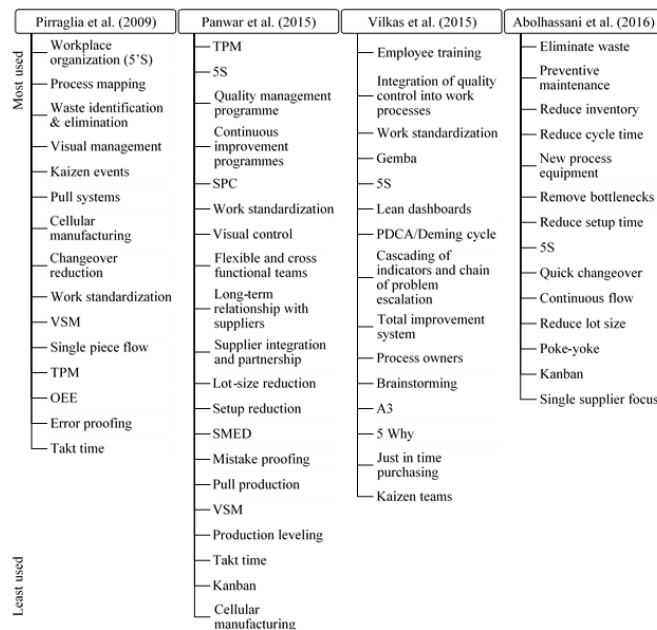


Fig. 1: Most popular LM practices based on the number of frequencies used.

### 2.2 Company size (number of employees)

There is a statistical difference in the frequency of LM practice implementation between small, medium, and large companies (Abolhassani et al., 2016), and there is a relationship between company size and the adoption of LM practices. Most studies concluded that larger companies are more inclined to adopt LM practices than medium and smaller companies (Marodin et al., 2016). For example, 85% of valid responses from medium and large companies indicated an average of 3 years of LM implementation (Hadid et al., 2016). Some researchers tend to exclude small companies or limit the respondents to medium to large companies, which have a higher

tendency to implement LM practices (Hadid et al., 2016). This is because large corporations have more resources to engage public-sector partners in the LM process. As a result, large corporations with more expertise and resources are more eager to implement more LM practices (Abolhassani et al., 2016). Medium and small businesses, on the other hand, lack critical resources such as capital, competencies, technology, relevant knowledge, and information to run their businesses more successfully (Tehseen et al., 2018). According to Marodin et al. (2016), medium- and small-sized companies are more like large-sized companies in terms of LM implementation. Even though large-sized companies use LM practices more, smaller firms can better convert them into performance (Shah & Ward, 2003). However, Panwar et al. (2015) cited that there is no evidence of LM implementation in small companies and concluded that the small companies refuse to adopt LM. Thus, Marodin et al. (2016) suggested that medium- and small-sized companies must adopt the LM implementation approach, which may be different from that of large-sized companies.

### 2.3 Company age

The literature about the association between plant age and lean implementation is contradictory. Plant age is negatively associated with implementation, and found that new plants that are less than ten years old were motivated by the adoption of lean tools. Concerning the plant ages, the new plant is more likely to implement LM as compared to the old plant, and in fact, starting to implement lean tools in facilities that have less experience in LM could be faster than in an experienced company (Abolhassani et al., 2016). Lean practices, such as employee training on lean principles and practices, integration of quality control into work processes, work standardisation, Gemba, and 5S, were the driving force behind the construction of the new plant.

### 2.4 Ownership

The diverse population of Malaysia, which includes Malays (Bumiputera), Chinese, and Indians, shapes business practices. The goal is to see which companies have a higher proclivity to implement LM practices. The Chinese community controls and manages the majority of Malaysian SMEs (Kheng & Minai, 2016). Unquestionably, they can improve organizational performance, especially when the Chinese practice of *guanxi* moderates it. Furthermore, Tehseen et al. (2018) found that there are positive impacts on the performance of all four types of companies run by Chinese entrepreneurs compared to others. In comparison, only a small number of indigenous or Bumiputera SMEs can sustain themselves in the wood-based product manufacturing industry in Malaysia. However, several studies have provided statistical evidence for the positive influence on companies' performance among Malay entrepreneurs. In comparison to Bumiputera and Indian companies, Chinese companies may have a higher tendency to implement lean practices, but there is variation.

## 3.0 Methodology

Based on the framework suggested by Abu et al. (2020), this study's research methodology. This provides a solid base for a well-planned, thorough investigation that follows the accepted guidelines and standards set out by those authors. Out of the 1,362 companies in the databases of the Malaysian Furniture Council (MFC), Malaysian Furniture Promotion Council (MFPC), and Malaysian Timber Industry Board (MTIB), 125 samples were screened and eliminated because they had duplicate records in various sources from joining various lean initiative programmes and duplicate records from the arrangement of product categories. For the pilot study, 148 companies in Kuala Lumpur and Selangor were chosen.

### 3.1 Age of plant

Three ranges of ages of plants were documented based on previous research. A company that has been operating for less than 10 years was categorised as a new plant, while if the company has operated for more than 20 years, then it was considered an old plant. Any company that only operated for 10 to 20 years was regarded as an adolescent plant. The percentages of new, adolescent, and old furniture companies' responses are 33%, 24%, and 43%, respectively (Table 1).

Surprisingly, the result shows that there is only a slight difference in the percentage of the age of the plant. There is a trend of the furniture remaining stable with the range of the plant and the rise of new plants to support an old plant that has been operating for more than 20 years. Therefore, it is interesting to know what the mean range of furniture industry ages in Malaysia is by changing the structure of the question into open-ended questions for the full survey.

Plant types	Years	Percentage (%)
New plant	less than 10 years old	33.3 %
Adolescent plant	between 10 and 20 years old	23.8 %
Old plant	more than 20 years old	42.9 %
	Total	100%

### 3.2 Size of company

Two factors that affect lean implementation in industries studied by previous research are the size of the company (based on the number of employees) and the age of the plant. 76% of furniture companies have full-time employees between 5 and 75 people. A considerably high percentage of furniture companies belong to the small-scale industry. Only 14% of the furniture companies can be considered medium-sized, and nearly 10 % of the companies are micro-sized (Table 2). Undoubtedly, wood and furniture companies in Malaysia

were still manufacturing in micro- and medium-scale sizes. Unfortunately, there is a shortage of workers faced by industry with a declining rate of local labour force. Furthermore, it has been branded 3D or dirty, dangerous and difficult, which has resulted in a lack of interest from local university graduates to join this industry due to its less-than-desirable perception.

Table 2. Company sizes are based on the number of full-time employees.

Company sizes	Number of employees	Percentage (%)
Micro size	less than 5	9.5 %
Small size	between 5 to 75	76.2 %
Medium size	between 75 and 200	14.3 %
Total		100%

#### 4.0 Analysis of the relationship between sizes and ages of the companies

Two-way frequency tables (cross-tabulation) present the percentage distribution of wood and furniture companies by age and size of the company. The hypothesis from the research question was tested to answer the following questions: First, does the size of the company differ between new and old plants? Second, is there an indication that new companies are more likely to implement lean than old companies?

Therefore, the hypothesis made from the first question is *H*: Is there a relationship between company age and the size of the company? Most of the respondents (76%) are small-size companies (Table 3). Marginally, over 80% of the new and adolescent companies have employees between 5 and 75 people (small size). None of the new and adolescent plants were medium to large size. However, three old plants were found to be a medium size company. Furthermore, none of the company that has less than five employees (micro size) has been founded to be operated for more than 20 years (old plant). It shows that the company grows year by year with an additional number of employees. The above are indicators that the company grow in size with the increase of plant age.

Moreover, the presence of a high number of new companies shows that there is a bright future for the Malaysian furniture industry. It is believed that the number of medium-sized plants will rise in the coming years with the rising number of new and adolescent companies.

Table 3. The two-way frequency between company size and age.

Company size	Age of company			Total %
	New plant	Adolescent plant	Old plant	
Micro size	14.3%	20.0%	0.0%	9.5%
Small size	85.7%	80.0%	66.7%	76.2 %
Medium size	0.0%	0.0%	33.3%	14.3 %
Large size	0.0%	0.0%	0.0%	0.0%

Next, the second hypothesis is *H*: Is the proportion of new companies implementing lean higher than that of old companies? The majority of the new companies implement lean, with 60% (Table 4). With the progressive participants from the new companies (below 10 years), the lean knowledge could expand in the furniture industry in the future. In contrast, slightly over 75% of companies that operated for more than 10 years (adolescent and old plant) are non-lean companies. The above are indications that lean implementation differs between new companies and companies that have been operating for more than 10 years. In addition, none of the micro-size companies implemented lean practices.

Table 4. Frequency of lean implementation based on company size and age.

Implemented lean	Yes	No
<i>Company Age</i>		
New plant	60.0 %	25.0 %
Adolescent plant	0.0%	31.3 %
Old plant	40.0 %	43.7 %
<i>Company Size</i>		
Micro size	0.0%	12.5 %
Small size	80.0 %	75.0 %
Medium size	20.0 %	12.5 %
Large size	0.0%	0.0%

## 5.0 Discussion

The investigations by Panwar et al. (2015), Abolhassani et al. (2016), and Marodin et al. (2016) dominate our debate. These research projects form the basis for our study of lean manufacturing frequency and implementation across wood and furniture company sizes. Each study implements LM techniques at different rates and found TPM among the least used LM approaches. Panwar et al. (2015) found that enterprises use TPM most often due to its cost-effectiveness. Industry benefits using LM include improved customer satisfaction, quality, waste reduction, production costs, and demand management efficiency (Panwar et al., 2015). Manufacturers must first test their ability to use lean manufacturing (LM) methodologies to ensure long-term success (Abolhassani et al., 2016; H. Gholami et al., 2019). Another consideration is firm-size categorization. Small, medium, and large-sized firms are classified as SMEs in the country where the research is being done, complicating matters. Marodin et al. (2016) and Abolhassani et al. (2016) defined small companies as those with fewer than 100, 80, and 50 employees, respectively. Malaysian small firms have 5 to 75 employees. Lean approaches are likely to increase with business scale, according to the authors. Sangwa and Sangwan (2023) conducted the most recent study on LM tool prevalence from this investigation. A systematic literature review identified the most common lean manufacturing practices using a search string ("lean manufacturing"), "ranking" AND PUBYEAR < 2023 OR PUBDATETXT (("January 2023" OR "February 2023" OR "March 2023" OR "April 2023" OR "May 2023" OR "June 2023" OR "July 2023" OR "August 2023" OR "September" OR "October")) AND (EXCLUDE (PUBYEAR, 2024)) AND (LIMIT-TO (LANGUAGE, "English")). Sangwa and Sangwan (2023) examined, valued, and organised lean practices in an Indian automobile component manufacturing company. Interpretive ranking processes (IRP) and ISM were used. The study identified lean practices from the literature and built two hierarchical models using ISM and IRP. The automobile component manufacturer used expert opinions to assess Lean Practice contextual links. This analysis prioritised and assessed practices by performance. ISM and IRP methods were used to create hierarchical structural models in the study. Value chain, system/technology, and organization-centric practices were the top priorities in the ISM-based Lean practices hierarchy. The IRP model showed performance hierarchies among lean techniques.

As mentioned, size has a wide impact, and most studies have found it substantial. There is strong evidence that large companies consistently apply LM. However, how LM adoption affects medium and small businesses is unknown. The wood and furniture industries are hard and resilient, but more companies are preparing to adopt LM and overcome digital technology challenges. The study's implications include helping companies allocate their finite resources by considering a hierarchical structure, helping managers understand how LM practices interact and how to prioritise them for optimal execution, and helping managers assign appropriate roles to employees and departments. The study was limited by a focus on specific research studies, regional and industry-specific prejudices, oversimplification of company age dynamics, self-reported data, and a company size definition based solely on employee numbers, which may not include all relevant factors affecting organisational capabilities. Those restrictions were: The research is confined to Panwar et al. (2015), Abolhassani et al. (2016), and Marodin et al. (2016), which may limit additional relevant perspectives and findings. The findings may be limited to Kuala Lumpur and Selangor wood and furniture companies. Age-based classification of companies into new, adolescent, and old plants may ease organisational development. Using staff numbers to classify companies (micro, small, or medium) may overlook other factors that affect their capabilities.

## 6.0 Conclusions

The research successfully synthesises key findings, providing a comprehensive overview of challenges and opportunities in LM in the wood and furniture industry, consolidating influential factors, and providing a delicate understanding of practical implications for the Malaysian furniture sector. It also emphasises the importance of contextual factors in LM topics. It is recommended that to gain a better understanding of LM across industries, researchers should use (1) a variety of sources, (2) broaden their geographical scope to include more representative companies, and (3) encourage collaboration between academia and industry to apply research findings in real-world scenarios effectively. The impact of leadership and company culture on the success or failure of lean initiatives should be investigated in subsequent studies.

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## Paper Contribution to Related Field of Study

This study contributed to The study can contribute to academic knowledge by adding insights into how lean practices are implemented in companies of different sizes and ages.

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