

# Lean Manufacturing Implementation from the Perspective of Small and Medium Enterprises

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**Abstract:-** Various manufacturers worldwide have successfully implemented lean manufacturing in their system. Nevertheless, unlike in many modern multinational companies, few studies have been conducted on this implementation in small and medium enterprises (SMEs). Lean manufacturing remains a difficult subject for most small and medium enterprises (SMEs); however, its benefits and the barriers to its implementation continue to be a discussion topic among such firms. Therefore, this paper discusses the implementation of lean manufacturing from the perspective of SMEs. It also presents the rationales for this adoption with respect to SMEs as well as the barriers that facilitate the practice of lean manufacturing in this context.

**Keywords:-** *Lean manufacturing, small and medium enterprises (SMEs), requirements, barriers.*

## I. INTRODUCTION

Small and medium enterprises (SMEs) SMEs are given various definitions internationally. This situation is due to the different levels of economic development in a country (Harvie 2008). According to Hamdani & Wirawan (2012), SMEs can be defined either by quantitative, qualitative or both. In quantitative methods, SMEs are defined based on a number of criteria, ie the number of employees, capital structure and annual sales index (Sidik, 2012). While qualitative methods typically apply the criteria of the type of enterprise, such as family businesses, traditional businesses and home-based enterprises (Wilson & Roy, 2009).

At global level, SMEs represent at least 80% of the entire company (Salikin et al., 2014). In the European Union economy, SMEs account for 99.8% of total enterprises, providing about 67% of the work and contributing 58% to gross value added in 2012 (Andersson, 2007). For German countries recognized as a country with economic strength in the European Union, 98.6% of its manufacturing companies are comprised of SMEs (GTI 2012). The Association of Southeast Asian Nations (ASEAN), where SMEs make up 96% of all companies, account for 50 to 95% of domestic employment, and 30 to 53% of GDP in 2012. In Thailand for example, SMEs represent 97% number of business enterprises. Thus, many SMEs endeavour to progress with the aim of attaining the status of World Class SMEs Organization.

To meet this goal, numerous challenges needed to be overcome. One criterion is the retention of an effective manufacturing system that considers the speed and duration of travel between the market and a customer (Andersson, 2007). Therefore, the adoption of a good manufacturing system

practice, such as lean manufacturing, is ideal for fulfilling these criteria (Andersson, 2007). Application of lean manufacturing to shop floors can assist the SMEs in gaining market share, enabling it to operate at optimum proficiency while beyond customer hopes, and revealing an organization's potential (Anand & Kodali, 2009; Okhovat, Khairol, Mohd, & Nehzati, 2012).

Nonetheless, lean manufacturing is not implemented simply for its own sake. The lean manufacturing needs to be supported by the concept of "value added" as it is essential principle (Gautam & Singh, 2008). Customers are willing to pay for the good quality of product but not for "non-value-added" (NVA) or waste product (Ng, Lim, Chong, & Goh, 2013). Thus, all manufacturing processes must be efficient. Furthermore, the people, equipment, or other resources involved should be organized in an integrated system at optimum efficiency.

In this research work, lean manufacturing was reviewed as an effective system for the SMEs. Moreover, the rationales behind implementing this practice in such SMEs were examined and barriers that can affect this adoption process in Malaysia were also identified. Finally, the conclusion of this research is presented.

## II. LEAN MANUFACTURING AS A GOOD MANUFACTURING PRACTICE FOR SMES

In many cases, SMEs worldwide remain unfamiliar with manufacturing system applications. This is because many of such enterprises are controlled by their owners (Blackburn, Hart, & Wainwright, 2013) whom are without a solid knowledge foundation in engineering. Many of these leaders merely imitate the successful practices implemented by large multinational companies. However, the background or the actual concept of manufacturing system application remains unknown (Deros, 2014); and as a result, most SMEs experienced negative production lead time, cycle time, quality, and resource capacity problems because the contexts may vary among the SMEs. Such businesses may also differ from large multinational companies.

The lean manufacturing was originally derived from the Toyota Production System (TPS), which focused on delivering the correct items to the right place at the appropriate time in the accurate quantity to achieve perfect workflow (Sullivan, McDonald, & Van Aken, 2002). Subsequently, TPS was studied and popularized by a group of researchers from MIT. Lean manufacturing was introduced during the late 1980s to eliminate waste from high-volume production and operation at the American Automotive Industry (Azlina, Salleh, Kasolang,

& Jaffar, 2011). The core driving functionality of these practices is that the companies can operate synergistically and coherently to create high-quality products and minimize NVA activities within the entire company.

Following its successful implementation in automotive companies, the concept of lean manufacturing was introduced to and developed for various major players industry worldwide (Rahman, Laosirihongthong, & Sohal, 2010; Yang, Kuo, Su, & Hou, 2014). Many of these companies acknowledged that lean manufacturing is “a technique that emphasizes eliminating non-value-adding (NVA) and minimizing of the resources used in various activities of the manufacturing process.” Furthermore, various organizations in service sectors, such as in the finance and health care industries, claimed that lean manufacturing is a universal system that aids companies in reducing cost, stabilizing the organization, improving service productivity, maintaining business profiles, and reducing the number of NVA activities (Robinson, Radnor, Burgess, & Worthington, 2012; Teichgräber & de Bucourt, 2012; Young, Hill, & Point, 2014).

Nowadays, lean manufacturing is applied by SMEs worldwide as a good manufacturing practice. For example, (Yang & Yu, 2010) conducted a study on implementation of lean manufacturing system in SMEs located in Wenzhou, China and determined that the adoption helps reveal the strengths and weaknesses of these firms during business operations. In addition, lean manufacturing assists organizations in maximizing the total time and efforts given to activities that merely add value for the end customer. Gurumurthy & Kodali, (2009) determined that by clearly defining the value for a specific product or service from an end customer’s perspective, the implementation of lean manufacturing facilitates the reduction of manufacturing waste and lead time. According to Khanchanapong et al., 2014, whom studied the organization of such enterprises in Italy, this practice also helps organizations reduce the cost incurred by manufacturing SMEs.

The successful implementation of lean manufacturing has smoothed the production flow and improved the quality of products generated by SMEs (Wilson & Roy, 2009; Khanchanapong et al., 2014). The identification and mapping of production streams through this practice had assisted SMEs in mapping out an entire set of activities across an organization as a whole. Rahani & al-Ashraf (2012) investigated this concept and concluded that lean manufacturing can map overall production activity. Moreover, this practice is a proactive concept for representing the end-to-end processes that deliver value to a customer. In addition, lean manufacturing helps optimize production flow by eliminating NVA activities on shop floors.

Many researchers agree that during the initial implementation of lean manufacturing, only 5% of SME organization activities are categorized as value-added (Andersson, 2007; Linné & Ekhal, 2013; Vinodh & Aravindraj, 2012). This is because many organizations, particularly such enterprises, did not consider waste in performing manufacturing processes. Gurumurthy & Kodali (2009) identified eight lethal production wastes that are

dubbed as “Down Time”: which are defect, overproduction, waiting, non-utilized Talent, transportation, inventory, motion, and extra-processing. These wastes and its definitions are as listed in Table 3.

Numerous tools like 5S, Kaizen, and Kanban were introduced through the concept of lean manufacturing to address these problems. Roslin, In example, Ahmed, Dawal, & Tamri (2012) applied 5S to clean and standardize organization processes. Previous studies by Elsey (1996) and Sofokleous (2007) implemented Kaizen to promote continuous improvement in an organization. While Rahman, Sharif, & Esa (2013a) utilized Kanban to reduce inventory problems. Many academicians agreed that eliminating these eight wastes ensures that the production process “flows” to the customer without interruption or delay (Naufal, Jaffar, Yusoff, & Hayati, 2012).

Production Waste	Definition
i. Defect	Rework, scrap and incorrect information
ii. Overproduction	Production that is more than needed
iii. Waiting	Wasted time waiting for the next step in a process
iv. Non-Utilized Talent	Underutilizing people’s talents, skill and knowledge
v. Transportation	Unnecessary movement of product or material
vi. Inventory	Excess product or material not being processed
vii. Motion	Unnecessary movement by people
viii. Extra Processing	More work than is required by customer

Table 3 Eight Production Waste Definition  
Source: Gurumurthy & Kodali (2009)

### III. THE RASIONALE OF IMPLEMENTING LEAN MANUFACTURING FOR SMES

The rationale behind the adoption of lean manufacturing must be determined given that this practice is currently not widely accepted by Malaysian SMEs. Many academicians regards lean manufacturing as a vital strategic tool for these enterprises to progress toward globalization; nonetheless, the number of organizations, especially SMEs, implementing this tool remains small (Saleh & Ndubisi, 2006b; Shafinaz, Rasli, Azura, & Mohd, 2014). The main reason for the failure to implement this concept is because the majority of local SMEs remains unconfident that lean manufacturing can facilitate positive effective performance in shop floors (Koe, Omar, & Sa’ari, 2015). From the perspective of these parties, no concrete evidence shows the capabilities of this practice to help Malaysian SMEs survive, especially in relation to three major issues, namely, the elimination of manufacturing waste, “Just-In-Time” production, and sustainability by people.

Nonetheless, for certain academicians, the aforementioned reason is simply an excuse for most local SMEs given the difficulty of acquiring information regarding the implementation of lean manufacturing in Malaysia (Salleh, Kasolang, & Jaafar, 2012). Furthermore, many Malaysian academicians and researchers actually have successfully

incorporated this practice into local SMEs (Hani, Rashid, Shaari, Mohamad, & Zakwan, 2010; Rahman, Sharif, & Esa, 2013b). For example, Nordin & Othman (2014) stated that the core of lean manufacturing philosophy lies in the premise of changing the technology management practices of Malaysian SMEs through enhancing production effectiveness, efficiency, and business performance. The five core philosophies of lean manufacturing include: i. specifying what creates value from the customer's perspective; ii. identifying all the steps along the process chain; iii. generating flows for these processes; iv. producing only what is pulled by the customer; and v. optimizing through continual waste removal. According to Habidin & Yusof (2013) these philosophies are the strong guidelines for Malaysian SMEs in terms of business motivation or activity to implement an effective manufacturing system in its organizations.

The implementation of lean manufacturing is also rationalized by the reduction of implementation costs incurred by Malaysian SMEs given that this practice can limit the dependence or burden of labor problems in all factories of Malaysian SMEs. Most of these enterprises still rely on worker force or energy rather than on machine orientation; therefore, lean manufacturing can shorten production hours and optimize shop floor spaces in contrast to the traditional mass production practice (Hani et al., 2010). These processes are beneficial because they can lift the burden of capital investment and production costs. These costs are regarded as obstacles for SMEs in Malaysia.

The positive development and production quality guaranteed through lean manufacturing can also facilitate the development of local SMEs such that they can compete for the contracts offered by large multinational companies (Agus & Iteng, 2013). In Malaysia, implementing this practice necessitates the acquisition of accredited certification from the Malaysian Production Corporation (MPC). This certification is given to any organization capable of innovation and competitiveness; thus, this award can be a catalyst for Malaysian SMEs to be recognized by multinational organizations and enable further business collaborations.

The implementation of lean manufacturing can also significantly assist Malaysian SMEs in developing good company culture. As discussed in the previous section, this practice helps SMEs communicate effectively in accordance with the concept of openness, as described in lean manufacturing philosophy. Martínez-Jurado, Moyano-Fuentes, & Jerez-Gómez, (2013) stated that clear communication aids all organization members in achieving clear and visible transformation by management. Comprehensible, visual information helps clarify how lean manufacturing can work in an organization to initiate change in a visible area.

Another point for rationalization is that the incorporation of concepts such as "Gemba" into lean manufacturing activities assists in raising awareness among members of management (Arezes, Dinis-Carvalho, & Alves, 2010). Most local SMEs are fully controlled by their owners, and management is more inclined to seek business opportunities rather than shop floor improvement. Lean manufacturing may

result in the renewal of business potential, which is a process wherein management requires employees on the shop floor to locate waste and opportunities to practice "Gemba kaizen" or practical shop floor improvement. Therefore, all staff, from members of management to employees, jointly understand the full effect of the problem personally.

The implementation of lean manufacturing not only generates internal benefits but also external opportunities for SMEs in Malaysia. These opportunities mainly include good infrastructure facilities in the country (National Economic Advisory Council, 2010), which is the most significant advantage of lean manufacturing practice in Malaysia. Roads, electricity and water supplies, and telecommunications are continuously being developed by state governments and private developers, and these investments have paid off over time. At present, Malaysia boasts some of the most well-constructed infrastructures among the newly industrialized nations in Asia.

In addition, a strong support from government and non-government organization (NGO) helps strengthen the adoption of lean implementation by Malaysian SMEs, especially with regard to increasing awareness and the development of technical knowledge or programs (Salleh et al., 2012). Malaysian governing bodies, such as MPC and Malaysian SMEs Corporation, have continuously monitored the effectiveness of lean manufacturing in the country. Similarly, Malaysian NGOs, such as FMM, educate and guide their members in the implementation of lean manufacturing. This NGO also pushes for the rationalization of this practice in Malaysia.

However, full lean manufacturing implementation remains a distant prospect given that awareness of this practice is very low. The limited understanding may be attributed to the lack of technical disclosure, success, or other issues after adopting this concept. The gaps observed in the implementation of lean manufacturing in Malaysian SMEs are discussed in the subsequent section to help researchers understand the corresponding weaknesses and shortcomings.

#### IV. BARRIERS RELATED TO THE IMPLEMENTATION OF LEAN MANUFACTURING AMONG SMES

SMEs are predominantly characterized by low volume, highly mixed product yield, and customized orders with variable volume rates, rather than orders to stock, frequent machine set ups or changeovers, and limited inventory processes (Chong, Cheah, Wong, & Deng, 2012; Ganagambagai & Shanmugam, 2012; Rahman, Sharif, & Esa, 2013). Thus, when the lead time on shop floors is high, the production environment is unstable, and "production cash flow" is reduced.

Some researchers stated that the failure to implement lean manufacturing is related to "how to create overall lean strategies on the shop floor" with minimal negative influence from outside of the organization. As per an in-depth examination of the situation, most problems can be categorized into a few clusters based on the 4 Ms, namely, man, machine, money, and method (or procedure). Man refers

to organizations whose operation includes management and support staff, whereas machine consists of the apparatuses and tools used on shop floors. Money refers to the ability to pay or spend, and method denotes the system or procedure applied in shop floors.

The most critical points of the barriers to the adoption of lean manufacturing by Malaysian SMEs are related to investment cost (Rahman et al., 2013b). The majority of such enterprises believe that every manufacturing system requires considerable expenditure; some businesses expect to spend on automated machines, high-end computers and software, and the training and hiring of professional consultants as a result of lean manufacturing implementation (Wahab, Mukhtar, & Sulaiman, 2013). In addition, local SMEs are concerned with return of investments, and organizations are concerned about over-budgeting and disruptions to production schedules in the event of delays (Dombrowski, Schmidt, & Schmidtchen, 2014; Dora, Kumar, Van Goubergen, Molnar, & Gellynck, 2013).

People are an essential element of any SME. Conti, Angelis, Cooper, Faragher, & Gill, (2006) reported that implementation of lean manufacturing will succeed only if every member of a company is committed and dedicated to the system. Many SMEs are self-managed; thus, knowledge and understanding of the lean manufacturing philosophy is crucial as this implementation may be rendered ineffective due to a lack of management support, poor procedure or standards, and vision. Al-Zuheri, Luong, & Xing, (2012) concluded that the management is the main driver for lean manufacturing implementation initiatives in SMEs. The other barriers to this adoption involves company workers themselves where Schlosser (2013) stated that some employees disrupt the implementation at the shop floor given that most SMEs employ people with low skill levels who have a limited background in lean manufacturing. In certain cases, employees fear infringement and cannot foresee the advantage of this practice (Ling & Shan, 2009). Table 5 listed out the barriers faced when implementing lean manufacturing in Malaysia based on 4Ms categories.

Categories	Barrier
Man	Lack of technical knowledge
	Sabotage from support staff
	Lack of Management Support
Machine	High variation and low Volume
	Ineffective Control System
Method	Not understand the relevance
	Distinctiveness from big multinational companies
	Wrong perception
Money	Small Capital
	ROI and Over budget issues

Table 5: The barriers for implementing Lean Manufacturing among Malaysian SMEs

Source: Gurusurthy & Kodali (2009)

As in Table 5, machine is another problem in lean manufacturing implementation, although they help SMEs operate efficiently. Highly variable and low-volume operations complicate machine setup by SMEs (Deo, 2013), and acquiring fast machines is not the ideal solution to this issue.

Related factors, including the setup time, process time, layout, number, and placement of machines, will influenced operating performance as well. Other aspects that contribute to NVA process wastes include a long setup period, significant distances between machines, transportation, and motion at shop floors. Azlina et al. (2011) also highlighted the failure of many local SMEs to systematically maintain machines and equipment.

Finally, researchers note situations wherein most local organizations collect, analyse, and report data without understanding its relevance to the company’s issues (Ling & Shan, 2009). Most of the data were not evaluated and were simply presented in “black and white” without considerable input. In a few cases, the methodologies used are complicated. This is because the SMEs merely copy the findings from seminars or from their mentors and this practice is ineffective because the researchers do not understand the relevance and implications of their results for implementation. Many reported cases exhibit the concept of “do it quickly, evaluate the result, and if change is unsuccessful, try another solution.” Ultimately, the competitive advantage of lean manufacturing is not utilized.

**V. CONCLUSION**

In previous studies related to the 4 Ms, issues are usually treated separately despite the fact that they are interrelated and facilitate effective lean manufacturing implementation in shop floors. However, lean manufacturing activities can be successful only if man, machine, money, and method compliment one another. As discussed in this paper, the managers of most Malaysian SMEs lack technical knowledge at the point of decision making. Therefore, these enterprises are reluctant to implement lean manufacturing ideas given that the distinctive requirements of these concepts often complicate the prediction of the magnitude of gains that can be achieved. The managers of SMEs cite insufficient justification and the lack of quantifiable evidence and successful testimonies as factors that convince them of the complication of this issue. Therefore, the viability of lean manufacturing should be enhanced from the perspective of SMEs, especially with respect to handling the 4 Ms. In contrast to SMEs, most multinational companies conduct computer-based simulations to support the application of lean manufacturing concepts in shop floors. In future studies, researchers should address the various issues related to lean manufacturing implementation in Malaysian SMEs, such as determining the optimum route for new build rails that are subject to multiple constraints.

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