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Lean manufacturing best practices in SMEs

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Abstract

Last two decades had witnessed explosion of researches into the area of manufacturing improvement such as lean manufacturing, total quality management, total productive maintenance and their application within various manufacturing companies such as automotives, electronics, plastics components and etc. It was proven that lean manufacturing was considered as the best manufacturing system in the 21st century. A comprehensive literature review was conducted to get necessary lean information. The review is focused on SME definitions and characteristics. This is followed by reviewing the lean practices and discusses them based on SMEs' capabilities. The aim of this paper is to present feasible lean practices for lean implementation in SMEs. There are seventeen lean practices which could be considered are feasible and relevant to the SME characteristics. The proposed practices were based on three categories; least investment, feasible to apply in SME and recommended by researchers.

Keywords

Lean, manufacturing, practices, small, medium, enterprises.

1. Introduction

Lean manufacturing (LM) is mainly inspired by the Toyota Production System (TPS) which has been focused on elimination of waste and improving customer satisfaction [1]. LM is a set of principles, philosophies and business processes to enable the implementation of it, which is widely known and implemented since 1960. Taj [2] had defined LM as manufacturing without waste. Thus, the authors define it as *a production system that focusing continuous flow within supply chain by eliminating all wastes and performing continuous improvement towards product perfection*. Waste is anything other than the required equipment, materials, parts, space and working time. According to Dankbaar [3] LM will be the standard manufacturing mode in the 21st century. Researchers agreed that LM could be a cost reduction mechanism and can be used as a guide to be world class organization [4]. Theoretically, LM can be applied to all industries and it is considered as strategic weapon in competitive market [1, 5, 6]. For example, Meier & Forrester [7] found LM was successfully implemented in the tableware industry. LM implementation requires time, money, energy and full company commitment [8]. It was noticed that LM has been implemented successfully in large organizations but there is still few documented evidence of its implementation in smaller organizations [9]. The increasing demand for high quality products and highly capable business processes by large organization has left no choice for the SMEs to consider LM implementation. Small companies have advantages such as they are more agile, much easier to get management support and commitment, as opposed to large organizations [10].

Past literature showed most of practitioners and researchers had highlighted LM could reduce inventories, lead times, improved knowledge management, rapid product development and robust processes. According to Lathin & Mitchell [11], producers can expect a reduction of 90% in lead time, 90% in inventories, 90% in the cost of quality and 50% increase in labour productivity, as a result of implementing LM. In addition, Ferdousi & Ahmed [12] had highlighted in their research on LM that the productivity had improved from 10%~60%, product lead time was reduced 8%~50% and product quality was improved to 8%~80%. The objective of this paper is to present a review on past literature regarding LM practices. The study will categories LM practices into three areas such as less investment, feasible to implement and recommended by researchers

2. Small and Medium Enterprises

SMEs have played tremendous role in manufacturing sector all over the world. In the year 2007, Malaysia has 96% of establishments of SMEs which contributed 30.7% of total manufacturing output and 26.3% of total value added [13]. In addition more than 400,000 or 31% of total Malaysian workforce were employed by SMEs. SME in Malaysia was defined as a company with full time employees between 5 to 150 and annual sales turnover between RM251k to RM25 million [14].
The new economy age on globalization has influence foreign products penetrate the Malaysian market, especially from China and India which offered lower cost compared to local product. Many Chinese companies have taken the market share from stronger manufacturers in Asia, Europe and the United States [3]. Nowadays, the suppliers are no longer in the same region with customer. Therefore, in order SMEs to survive in a challenging age, these companies should look forward to improve the existing system and fulfill the customer needs. One of the approaches which are considered best management practice to all industries is LM [1,2].

3. Lean manufacturing implementation in SMEs

The systematic implementation of LM in SMEs will yield huge benefits such as quality improvement, reduction in cycle time and good customer responsiveness [52]. Although SMEs faced difficulties when dealing with suppliers and customers on parts delivery and demand [15, 16], it is still applicable for SMEs to implement lean by concentrating on internal process such as employee involvement and participation [17]. Furthermore, Panizzolo [18] discovered 27 excellent manufacturers in Italy had widely adapted lean improvement programs relatives to internal process. The internal process is started from receive orders until the parts are delivered to the customers. In addition, Lee [19] also pointed this view by proposing SMEs to implement feasible practices which are in their control and manageable with limited resources. However, Lee [16] insist SMEs to focus in house elements which are less financial investment in lean implementation such as 5S, quality circle, preventive maintenance and employee involvement. The explanation shows that these practices are very important to SMEs in order to be successful in lean implementation. The finding was similar to a study done by White et al. [20] which found that most of the small companies in US applied quality circle and multifunction employee. Quality circle is considered favorite to SMEs is due to its simplicity and easy to adopt by all industries. Apart from that this practice also could enhance the employee participation and involvement in the organization. Researchers [19, 21, 22] stressed that the SMEs should start with minimal financial investment on lean practices such as Kanban, 5S, and Honshin. Herron & Braiden [23] had pointed out five basic practices (*employee involvement, quality circle, standardization, 5S and set up reduction*) as a stepping stone for developing LM in the organization. The argument shows that the SMEs have the opportunity to implement lean provided with the correct practices. In addition, researchers [19, 24, 25] had pointed out that there is no obstacle to SMEs to implement lean successfully. The highlighted practices generalized that researchers had different point of view on lean practices and there is no standard practices available for SME to adopt, but the common goal is with least investment. However, the above explanation shows some of the lean practices are not complicated to SMEs to follow such as 5S, quality circle standardization and multifunction employees. The comprehensive reading on lean literatures provides the authors to classify lean practices into three groups;

i) those that are independent of the size of firm, and
ii) those that relate to the size of firm and may be more difficult for SME to employ.
iii) those that can be implemented in piecemeal such set up reduction, 5S, TPM, multifunction employees.

4. Lean practices

There are more than hundred lean practices available and being practiced by industries [26]. Researcher [27] had suggested that the company should implement all or most of the lean practices in order to success in lean implementation. However, Anand [53] insist the organization to implement 65 lean practices. Numerous of publication strongly proposed that the company should implement comprehensive of lean practices rather than in a

piecemeal [7, 28, 29]. Karlsson & Ahlstrom [30] in their study claimed that the SMEs could success in LM as large company.

Do the small companies have to implement all practices at once or can be implemented partially?

The reviews show that the SMEs are incapable to implement all practices at once [16, 19, 21]. The alternative to SMEs is to sequentially run the feasible practices which from the easiest or cheapest lean practice [16]. This approach could minimize the financial and employees commitment which should be imposed on lean practices. In addition, the SMEs could make the feasible practices as a stepping stone to be lean enterprise [23]. Because of this reason, the authors have reviewed 16 highly cited journals and discovered 17 practices which highly highlighted in their papers [1, 18, 19, 20, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42]. The list of best practices are as follows; *reduce set up time, Kanban, small lot size, supplier management, preventive maintenance, multifunction employees, uniform workload, visual control, employee involvement (quality circles), Total quality management, training, teamwork, production smoothing continuous improvement, 5S and standardization.*

Among the three most implemented lean practices suggested by researchers were reduced set up time, kanban and small lot size. These practices were considered very critical to lean implementation [43]. Failure to run these practices efficiently might cause the production delay and unable to maintain continuous flow. Whereas the least suggested were 5S and standardization. As to ensure the selected practices are not bias to the size of organization, the second review has been conducted to publications which were focused on SMEs. The finding shows that most of the seventeen practices were also recommended by several researchers to SMEs as depicted in Table 1. It is a quite interesting as, teamwork was not highlighted, as shown in Table 1. However, other elements related to teamwork such as multifunction employee, quality circle and continuous improvement were highlighted. This show that this element is also considered important to SMEs.

Table 1: Recommended practices for SME

Researchers / Practices	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Multifunction employee		*			*	*	*		*	*
Quality circle		*		*	*	*			*	*
Set up time reduction		*	*			*			*	
5S	*			*		*				
Kanban						*	*	*		
Continuous flow	*					*			*	
Preventive maintenance		*				*			*	
Small lot size	*					*			*	
TQC		*				*				
Kaizen(CI)		*	*							
Cell layout			*			*				
Standard operation	*	*								
Training			*				*			
Focused factory							*			
Supplier management			*							
Visual control		*								
Teamwork										

Source: 1 [44], 2 [25], 3 [40], 4 [21], 5 [20], 6 [19], 7 [45], 8 [46], 9 [47], 10 [17]

Table 2: The list of selected practices for SME implementation

Criteria / Practices	Less investment	Feasible implement	Recommended to SME
Set up time reduction	Y	Y	X
Visual control	Y	Y	X
Cell layout	Y	Y	X
Standard operation	Y	Y	X
Kanban	Y	Y	X
Continuous flow	Y	Y	X
Uniform workload	Y	Y	X
Small lot size	Y	Y	X
TQM/TQC	Y	Y	X
Continuous improvement	Y	Y	X
5S	Y	Y	X
Quality circle	Y	Y	X
Multifunction employee	Y	Y	X
Training	Y	Y	X
Teamwork	Y	Y	X
Supplier management	Y	Y	X
Preventive maintenance	Y	Y	X

Note:
MPE: Manufacturing process and equipment; PPC : Production planning & control; QM: Quality management; HRM : Human resource management; SM: Supplier management; TPM: Total preventive maintenance.
Y: will be furthered analyze in survey questionnaire
X : as per suggested by researchers in Table 1

Table 2 shows the suggested practices which are categorized to three categories in the perspective of SME, namely;

i) Less investment – not much cost will be invested on selected practices
ii) Feasible to implement - capable to implement with existing resources and able to improve manufacturing performance
iii) Recommended to SMEs - recommended by researchers and practitioners particularly in SME environment.

5. Discussion and conclusion

This study has focused on feasible lean practices which are required to be implemented in order to be successful in lean implementation. Due to financial and resources constraints, SMEs are reluctant to implement LM before foreseen the benefits of lean [9]. Therefore, in this study, the authors have proposed the feasible lean practices which are generic to SMEs characteristics as depicted in Table 2. The proposed practices were based on three categories; least investment, feasible to apply in SME and recommended by researchers. Among the lean practices that require least financial investment are 5S, visual control & display, standardization of operation, Statistical Process Control (SPC) and quality circle [21, 25]. Therefore, SMEs should apply these practices first and then followed with other practices such as kanban, small lot sizes. Kanban & small lot sizes practices can be implemented once the production flow is efficiently run, with minimum machine breakdown, quality problems and parts shortage. Even though piecemeal implementation of lean practices may not gain full benefits, but the step taken could help SMEs to improve their performance gradually [48]. Since there is still lack of research been carried out in Malaysian SME on lean practices implementation [49], the authors will expand the body of knowledge by looking at the following four criteria. These criteria will serve as the basis for future empirical based research.

i) The relationship between each of fundamental practices;
ii) The relationship between each of fundamental practices and manufacturing performance;
iii) The relationship between each of fundamental practices and seven wastes. Waste comprises of *unnecessary motion, defects, overproduction, waiting, transport, inventory, inappropriate processin*g [33, 50, 51]; and

iv) The relationship between in house capability, lean practices and manufacturing performance.

The finding in this paper can be validated through survey questionnaire which is planned to be distributed to Malaysian automotive SMEs.

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