

COMPARATIVE STUDY ON THE IMPLEMENTATION OF LEAN MANUFACTURING TOOLS IN MANUFACTURING COMPANY

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Abstract - This study aims to recognize the general perspective of industrial company operating in Sabah, focusing on the implementation selected tools of lean manufacturing. The objective of this research was to do comparative study on implementation of lean manufacturing and its tools among manufacturing company located in Sabah. The problem faced and the affecting factor in implementing lean manufacturing tool as well as the benefits experienced after the adoption of lean manufacturing tools were being identified. The scope covers manufacturing company of any types of industry that is actively operating in Sabah. Instrument of study is a survey questionnaire that contains open and closed ended questions, sent out to target respondents. This study finds significant evident of the implementation of lean manufacturing and its tools among manufacturing companies in Sabah, as well as the problem faced in implementation, factors of implementation and benefits experienced after the adoption of lean manufacturing tools based on the data analysis done using descriptive statistics to explain the trends in dataset and Cronbach's Alpha to test the internal reliability of the instrument.

Keywords - Lean Manufacturing, Industrial, Lean Manufacturing Tools

I. INTRODUCTION

The current strategy used by most companies nowadays is a traditional manufacturing approach that focused on producing a set number of products each period and kept them reserved in the inventory in case of unexpected demands or shortages. This caused companies to hold a large amount of inventory and overproduction. In addition, employees only do jobs/works that are assigned to them without any systematic management, in which this particular method causes employees to perform unnecessary works [1]. This affects the product development of the company and cause slacks which, therefore, lead to failure in tracking manufacturing process in details, in terms of activities, and also affects the ways of information transmission including how and when the next step should be taken. This is an indication that approaches in management has a vital role to the companies' production line.

In conjunction, Malaysian Productivity Corporation (MPC) has been introducing lean management since 2011 to various organization and since then, MPC has held seminars which attended by 1,587 participants from 376 companies. Government departments and companies in the State has been advised to consider implementing the lean management system in their organization [2].

Most study that have been done based on lean manufacturing implementation are focused on peninsular region. Wong et al (2009) examined the adoption of lean manufacturing in the Malaysian electrical and electronics industry [3]. Noraini Nordin et al (2010) investigated the lean implementation in Malaysian Automotive industry [4]. Ng et al (2015) studied the analysis of lean manufacturing tools in Malaysia's manufacturing industry [5]. On the other hand, review made based in East Malaysia, Sabah to

be specific is still lacking. Therefore, there is a gap in reviewing the level of understanding and status of implementation of lean in manufacturing companies which originates in Sabah are still unknown although it has been long introduced in Sabah.

While some may have perspective about lean concepts in general, there has been less review about the status of implementation of specific tools listed in lean manufacturing. Acknowledgement in implementation of lean tools and the characteristic such as problem in implementation, its factors and benefits among Sabah Manufacturing industries are still not identified. Due to lack of support and advices, these organization might not be able to experience lean manufacturing's benefits.

This study will attempt to provide meaningful data and answer the following objectives:

- To access the level of the implementation of lean manufacturing and its tools among manufacturing companies operating in Sabah
- To identify the problem faced and factors in implementing lean manufacturing tools among manufacturing companies in Sabah
- To acknowledge the benefits experienced by the manufacturing companies in Sabah after implementation of lean manufacturing tools

1.1. Problems in implementation

A case study by Abhay et al (2014) identified several barriers based on their observation in a manufacturing organization [6]. Their observation listed significant barriers such as poor training, lack of awareness among the staff, lack of communication, and gap between top management and employees. In conjunction, according to One et al (2005), barriers in lean tools implementation are lack of commitment and leadership from top management, lack of proper training and education as well as resistance from the

employees. In addition, they also included non-conducive environments in the adoption process as one of the challenges [7].

Atif Qamar Malik (2014) observed more details obstacles that raised during the process of implementing lean tools, which were workers only do a minimum effort in doing tasks, workers did not follow the guidelines given during the training program, and management is reluctant on investing in employees' training [8].

1.2. Factors of implementation

Nowadays, lean manufacturing tools is increasingly recognized as a management technique that enhances productivity and competitiveness [9]. In India particularly, the small scale industries (SSI) contributes a vital segment of the Indian economy in terms of industrial production, exports, employment and creation of an entrepreneurial base. Simply, small manufacturing firms face massive challenges in this world that is always transforming. Hence, the pressure to rapidly introduce new creation in an increased quality and reduced cost has led them to find a solution to improve their performance [10].

Due to tough competition worldwide, rejection/error in manufactured parts at various stages of manufacturing must be avoided in today's production line. Manufacturing industries are heading towards the direction of zero defect production. Varun Kumar (2016) further added that producing high quality of products and services is listed as one of the key concerns in order to compete in the global markets [11]. They further explained that production of product in 100% without any defect is not only a challenge, but also a necessity for companies. This forces company to put great effort on preventing faulty products and services by any means, before customers received them. Consumers expect highest quality, reliable delivery and competitive pricing from the manufacturers. This challenged companies to look for new strategy to save costs, develop employees to face future obstacles and develop new culture at workplace.

1.3. Factors of implementation

It is important to note that, lean approach is to produce more while consuming less. In conjunction, a study by Wójcik et al (2015) on the impact of lean manufacturing tools to the company's operation improvement, stated that the following phenomena are noticeable: an increase of employee's motivation, development of a company's organizational culture, reduction of costs associated with production of products as well as improvement in products quality. The study also concluded that waste in term of waiting is eliminated [12].

The benefits of lean implementation are the increased in customer satisfaction, workplace safety, efficiency and quality. Previous study noted that it reduced the cost of doing business, reduced inventory as well as

improved employee morals. These are the benefits that are cited frequently Lean manufacturing are popular and widely applied as a way to improve operational performance by reducing inventory and increasing quality levels. Marodin (2018) also found that lean manufacturing practices have a positive impact on quality improvement in a way that it reduces process variability by standardizing work methods to ensure the availability of equipment, materials and trained workers [13].

II. METHODOLOGY

A questionnaire was developed to collect data for this study, which consist of two parts; (A) the background information of the respondent and the company itself, and (B) the lean manufacturing implementation. A five-point Likert scale was also included which identifies the problem face, factors of implementation and benefits obtained from the implementation of lean manufacturing.

The sample space was obtained from the database of Federation of Malaysia Manufacturer (FMM) and Federation of Sabah Industries (FSI) which only target on manufacturing companies in Sabah. Questionnaire will be distributed, and a period of time will be given for the data collection. Main method of questionnaire distribution is through email however other alternative methods will be carry out to increase the response rate.

For the questions especially the form of Likert scale, Cronbach's alpha is the common measure of its internal consistency or reliability. Reliability refers to the extent of consistency produced by a scale, for a repeated measurement. Having a measure with good reliability signifies the internal validity and ensures that the data obtained can be trusted to represent the participant's performance. The general practice value of Cronbach's Alpha, α is approximately 0.70, yet it can be as low as 0.6. Hence, $\alpha \geq 0.70$ is sufficient to assume that it is reliable [14].

III. RESULTS AND DISCUSSION

The responses were representative of the type and spread of industries within Sabah, with West Coast being the location of most of the companies involved in manufacturing operations. Most respondents were representatives of in the position of engineers, with an approximate number of 40% from the respondent pool. The distribution of the manufacturing company included in this study among the various industries based on the product they manufactured portrayed that 28% of the manufacturing company belong to the Electricals & Electronics industry, followed by construction industry (20%). The respondents were mostly from small companies with less than 50 range number of employees which exhibits 40%, closely followed by those from big companies with more than 100 employees.

To further verify the extent of lean implementation in Sabah, the respondents are asked about their knowledge involving lean manufacturing. This is important to know their knowledge and awareness about lean manufacturing in general. Figure 1 shows the percentage of lean manufacturing awareness.

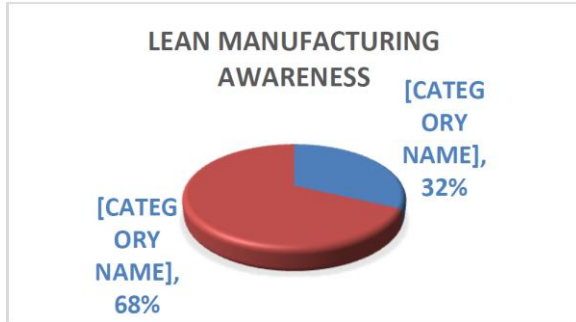


Fig.1. Lean manufacturing awareness

Table 1 shows the frequency of lean manufacturing tools that have been implemented in 10 companies, distributed with respective industries that the companies are involved in. The most used tools are 5S and KPI.

Lean Manufacturing Tools	Industry types				
	Construction	E&E	Metal	F & B	Agriculture
5S	///	/	/	//	/
Bottleneck Analysis	/		/		
Continuous flow		/			
Heijunka		/		/	
Hoshin Kanri		/		/	
Jidoka			/	/	
JIT		/	/		
Kaizen		/	/		
KPI	///	//		/	/
OEE	/	/		/	/
PDCA	/	//	/		
Root Cause Analysis	/		/		
SMART Goals	/	/		/	
Standardized work		/		/	
Tact Time	/			/	/
TPM	/			/	/
Value Stream Mapping				/	
Visual factory				/	

Table1. Distribution of lean manufacturing tools based on industry type

With 5S and KPI being most applied tools, each company implemented at least two lean manufacturing tools in their company. 5S was viewed as the easiest lean strategy to implement as 5S is the gateway for companies to begin the transformation to lean manufacturing. Implementing the 5S strategy sets up the change in culture required for structured continuous improvement. 5S allows for a visible and disciplined change where employees can recognize a lean manufacturing method in action that focuses on workspace organization and the elimination of non-essential equipment [15]. While, KPI is highly implemented because it can be used in all areas of business as it is a measurable value applied to

business objectives. In simple words, KPI is able to tell whether the company is moving forward or backward, which is useful in the decision-making process and help to drive the growth of the company forward.

Table 2 displays the value of Cronbach's alpha coefficient of all the items is within the range of 0.774 to 0.813. This indicates that all the items have a good degree of internal consistency. Furthermore, the "Cronbach's Alpha if item deleted" column estimates the value of Cronbach's Alpha if that particular item is deleted. As shown in the table, some of the values in that columns are higher than the Cronbach's Alpha hence that item can be removed to improve internal consistency for more accuracy.

No	Variables	Cronbach's Alpha if item deleted	Cronbach's Alpha
Problem faced in implementing lean manufacturing tools			
1	Lack of training	.604	.774
2	Lack of resources	.707	
3	Resistance from staff/employees	.610	
4	Adoption/maintenance is complicated and costly	.845	
Factors of implementing lean manufacturing tools			
5	Pressure from top management	.675	.783
6	To increase business opportunities	.683	
7	Desire to employ world best practice	.747	
8	The drive to focus on customers satisfaction	.649	
9	To reduce waste in production	.899	
Benefits of implementing lean manufacturing tools			
10	Helpful in increasing business opportunities	.781	.813
11	Organisation become more productive	.739	
12	Any operation become more effective	.739	
13	Efficiency in meeting customer satisfaction increased	.806	
14	Waste in production decreased	.826	

Table2. Cronbach's Alpha reliability test

The least applied tools are visual factory, value stream mapping, Jidoka, and continuous flow. This may due to high level of difficulty in implementing these tools, which reduces the chance for success. Among all the mentioned tools, continuous flow has been listed as the most difficult lean tools to implement based on [15]. On other note, the following are the list of tools that were not implemented by any of the company.

- Andom
- Kanban (Pull sytem)
- Muda (Waste)
- Gemba (The real place)
- Poka-yoke (Error Proofing)
- Single Minute Exchange of Die (SMED)
- Six Big Losses

3.1. Problem faced in implementing Lean Manufacturing

Lack of resources has the highest agreeability which can be further postulated as financial constraints that the company may face, due to company size as majority of the respondents come from small companies. It is also important to note that there is a significant agreeability that companies faced problem in implementing lean manufacturing tools due to lack of training and resistance from staffs.

3.2. Factors of implementing Lean Manufacturing

For factor of implementing lean manufacturing tools, the highest agreeability is due to pressure from top management and the drive to focus on customers' satisfaction. These two factors correlate with each other as to compete in today's rapidly transforming worlds, manufacturing companies face massive challenges hence the pressure to introduce new techniques is necessary to improve company's performance [10].

3.3. Benefits gained from implementing Lean Manufacturing

There is a significant evident that companies benefit from implementing lean manufacturing tools however this statement is arguable by looking at the amount of "neutral" and "disagree" responses. Even though some company agree that lean manufacturing tools implementation are beneficial in their company, the same amount of neutral or unsure responses were received. This may be due to lack of knowledge and awareness of the representative regarding the company's performance and productivity. Other reason such as incorrect implementation, might as well contribute to the amount of neutral and disagree responses.

IV. CONCLUSION

Study of lean manufacturing implementation assists individuals in understanding how companies are pursuing improvements initiatives in real world situation. It explores how lean concepts are being implemented and applied in a practical setting rather than detailing an idealistic situation. Based on the data collected, conclusion can be used to help identify the strengths and deficiencies. This study benefits companies that participate in this study, especially companies that have not implement any lean tools, to learn and educate themselves from companies that have already engaged in lean tools. This research is valuable because it gathers data from both lean and non-lean facilities in real world, allowing an evaluation of effectiveness and direction in implementing lean manufacturing. Future research and development can relate to the ideas stated and studied here for new, improved and more efficient manufacturing system especially around the scope of study.

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