Lean manufacturing approach for improvement of SMEs in Indonesian Industry

Anita Susilawati, a,* John Tan b,**

a) Department of Mechanical Engineering, Universitas Riau, Pekanbaru, 28293, Indonesia
b) Department of Mechanical & Construction Engineering, Northumbria University, Newcastle Upon Tyne, United Kingdom

*Corresponding author: anitasusilawati@yahoo.com,* k.tan@northumbria.ac.uk,**

ABSTRACT

Globally SMEs face challenges from competitions which drive them to strive to improve their performances on a regular basis. The purpose of this paper is to introduce the lean manufacturing approach as a means to improve productivity and management of the SMEs in Indonesian industries. This paper discussed and described the implementation of lean manufacturing tools and techniques which has evolved to be a form of corporate culture within the Indonesian manufacturing industries, especially for the SMEs. Moreover, this paper also discussed the “how to” aspect of improving the productivity of a given company as well as the management systems by identifying waste that occurs and reducing and/or removing the identified waste. Some case studies from the Indonesian manufacturing SMEs were presented to illustrate the implementation of the lean manufacturing approach. The outcomes of implementations from the case studies confirmed improvements in performance for these SMEs as a result of adopting the lean manufacturing tool and techniques.

KEY WORDS: Lean manufacturing, SMEs, Indonesian industry.

1.0 INTRODUCTION

The manufacturing industries sector is an important contributor to the Indonesian economy. In 2013 this sector’s contribution was 23.70%, being the highest contributor to the Indonesian economy while the non-oil processing industry contributed approximately 20.76% (BPS-Indonesia, 2014). According to BPS-Indonesia (2014) [1], the number of large, medium and small-sized enterprises within the manufacturing industry in 2013, was 555,292. Of this number, 23,941 were large and 531,351 of the Small and Medium sized Enterprises (SMEs). However, the manufacturing industries in Indonesia were not as efficient as they could be in production techniques, and with regards to the world market were lacking in competitiveness [2-3]. According to Deloitte (2013) [4], in its index in relation to the competitiveness of manufacturing industries, Indonesia was ranked unfavourably 17 out of 20 countries which achieved a low score of 5.75 of 10. This was in stark contrast to China which had achieved the highest score of 10.

The Indonesian manufacturing industries share of value addedness in “small & micro-size” enterprises was relatively small. However, they provide a larger contribution than “large & medium-size” enterprises in terms of the number of establishments and employment sources. In 2013, the number of people employed by these “small & micro-size” enterprises was 9,734,111, whilst it was 4,382,908 for “large & medium-size” enterprises [1]. Unfortunately, the “small & micro size” enterprises within the Indonesian manufacturing industries have faced numerous challenges in developing and improving their competitiveness due to constraints in technology and a lack of skilled employees. According to Tambunan (2006) [5], the “small & micro-size” enterprises within the Indonesian manufacturing industries have experienced less investment and were inclined to use traditional technological operations that are labour intensive but with relatively low productivity. This may have led Dhanani (2000) [6] to argue that it was not appropriate to develop supplier and support industries that involved a decrease in the Indonesian manufacturing industries.

Therefore, there is a matter of urgency for the Indonesian manufacturing industries to improve the quality of their products, management systems and to be more competitive, especially for SMEs. The lean manufacturing system can be considered as an attractive solution to the current situation as a means to enhance
manufacturing and technology in Indonesia’s manufacturer industries.

2.0 LITERATURE REVIEW

2.1 Lean Manufacturing Overview
Lean manufacturing or lean production originated from Toyota Production Systems (TPS) and has been widely applied in the manufacturing industry around the world [7-10]. Ohno (1988) [7] from TPS defined lean manufacturing as activities that involve value added work, continuously removing waste and non-value added work. The value-added activities start with suppliers of raw materials, processes and output products that the customer needs. The non-value added activities or waste include any unnecessary activities right from the supplier up to the finished product destined to customers. In other words, lean manufacturing provides a way for doing more using fewer amounts of human effort, time, equipment and space. Such approach will provide customers with exactly what, when, where they want it, and at the price they expect.

According to Bohemia (2000) [11], management technique, design method and production technology are the key indicators for assessing the potential benefits of lean manufacturing. Wong et al. (2009) [12] assessed lean manufacturing implementation based on 14 key areas of lean manufacturing namely: scheduling, inventory, material handling, equipment, work processes, quality, employees, layout, suppliers, customers, safety and ergonomics, product design, management and culture, tools and techniques. The meaning of lean tools and techniques are understood in several diverse ways and a summary of selected authors’ perspectives can be seen in Table 1.

2.2 The SMEs of Industries in Indonesia
In terms of size, manufacturing companies can be classified into large, medium, small and cottage/micro industries. A large company consists of more than 99 employees; a medium company is one that employs between 20 and 99 persons; a small company is one that employs between 5 and 19 persons; whereas a cottage/micro industry is one with less than five employees [1]. The SMEs in “Bahasa” is UKM/IKM (Usaha/Industri Kecil dan Menengah). According Berry et al. (2011) [13], the SMEs has a significant contribution on economic due to: (1) the biggest potential source of the labor force, (2) Used the small investor/capital and low risk for run their business, (3) used the small number of employees and easy to manage their business management.

The SMEs in Indonesia has an important role as the extensive sources of labour force, increasing the number of business units and support household incomes. However, there are several weaknesses within the Indonesian SMEs such as a lack of technology, capital, human resources, and weakness of managerial system [14]. Moreover, various other factors also added to the relatively low productivity: the limited knowledge on production technology and quality control, a lack of education and training, a lack of knowledge about marketing, due to the limited information that is accessible to SMEs on the market and the limited ability of SMEs to provide products/services in accordance with market demand. The Indonesian SMEs sector is considered a newly emerging industrial market in terms of competition with other established world-class industries. Hence, the Indonesian SMEs need to boost that industries and create diversity in the market. Therefore, implementing a world-class manufacturing system such as lean manufacturing would be helpful for the SMEs to address their weaknesses, and make them competitive in the global market.

3.0 LEAN MANUFACTURING APPROACH IN THE SMEs

For the SMEs sector the lean manufacturing approach can be implemented with various tools and techniques [9, 20]. Regardless of the type and size of an organization (large, medium, small and micro) it is crucial to reduce waste so as to increase business performance. Rose et al. (2011) [22] mentioned that waste identification through value stream mapping can increase the profit for SMEs. According to Womack and Jones (2003) [21], waste can be associated with activities such as excess motion, waiting or time delay, defects, inappropriate processing, over production, excess inventory, transportation and lack of knowledge. A review paper by Rose et al. (2011) revealed 17 recommendations of the lean manufacturing tools and techniques that can be adopted by the SMEs. The most commonly implemented were multifunction employee, quality circle, set up time reduction, 5S, Kanban, continuous flow, preventive maintenance and small lot size [22].

According Susilawati et al. (2011) [23], the SMEs in the Indonesian industry adopted lean tools and techniques in lesser extent and 5S was the most implementation. They identified twenty lean activities i.e. 5S, andon, cellular manufacturing, kaizen, kanban, line stop authority, low cost automation, material resources planning, milk run systems, nearby supplier, poka-yoke, production leveling, quality cycle, single minutes exchange dies, six-sigma, statistical process control, total productive maintenance, total quality management, value stream mapping and visual control.

The successful of lean implementation in SMEs can be influenced by the specific culture of a given nation, people mindset, geographical dispersion, and different management styles [24]. The successful implementation of lean manufacturing depends on cooperations and incorporations of the local societal and organisational culture [25]. Therefore, the Indonesian SMEs should implement lean manufacturing, which is adjustable to the local culture i.e. the lean tool and techniques acceptable in their particular areas of business and corporate culture.

Lean Manufacturing Characteristics
This section described how the lean manufacturing approach can be used to improve productivity, as well as the management systems. Productivity and profit are two significant indicators for measuring financial performance in a lean company. According to Barber and Lyon (1996) [26], financial decision on measurement of financial performance is linked to elimination of waste, resulting in reduced costs of productivity. Lean manufacturing can reduce costs by eliminating waste and contributing to higher product quality and on-time delivery. Fullerton et al. (2003) [27] also found that lean manufacturing indicators such as Just-In-Time and reduced setup time have certain positive correlation.
with financial performance, but it has a somewhat negative correlation with quality indicators. Ruch (1982) [28] outlined ways for increasing productivity i.e. producing more output with the same level of input and increasing the level of output faster than the input. In other words, waste elimination is very important to be applied in any activity aimed at increasing productivity [29]. Moreover, several authors [27, 30, 31], found that profit has a positive relationship with lean manufacturing activities. Fulfillerton and Wempe (2008) [32] pointed out that profitability is a crucial issue in the performance of a lean manufacturing company.

Table 1: The lean manufacturing tools and techniques by various authors

<table>
<thead>
<tr>
<th>Lean tools</th>
<th>Lean tools</th>
<th>Lean techniques</th>
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<th>Lean tools &amp; techniques</th>
<th>Lean tools &amp; techniques</th>
</tr>
</thead>
<tbody>
<tr>
<td>• SS</td>
<td>• Kaizen</td>
<td>• Standardized work</td>
<td>• TQM</td>
<td>• Cellular layout</td>
<td>• Other quality practices</td>
</tr>
<tr>
<td>• Value stream mapping</td>
<td>• Kanban</td>
<td>• PDCA (Plan, Do, Check, Act)</td>
<td>• JIT</td>
<td>• Heijunka</td>
<td>• Total productive maintenance</td>
</tr>
<tr>
<td>• SS housekeeping</td>
<td>• Daily schedule adherence</td>
<td>• JIT purchasing</td>
<td>• TPM</td>
<td>• Six sigma</td>
<td>• Employee value stream mapping</td>
</tr>
<tr>
<td>• Andon visible control</td>
<td>• Small lot size</td>
<td>• Kaikaku radical improvement</td>
<td>• One piece flow</td>
<td>• Andon</td>
<td>• Continuous improvement</td>
</tr>
<tr>
<td>• Layout improvement</td>
<td>• Just-in-Time</td>
<td>• Kaizen continuous improvement</td>
<td>• TQM</td>
<td>• SMED</td>
<td>• Zero defects</td>
</tr>
<tr>
<td>• Physical arrangement of equipment</td>
<td>• Pull/Kanban</td>
<td>• Kanban pull production control</td>
<td>• Layout</td>
<td>• Cell manufacture</td>
<td>• Just-in-time (JIT)</td>
</tr>
<tr>
<td>• Application of preventive maintenance</td>
<td>• Quick changeover</td>
<td>• Pull production systems</td>
<td>• Production</td>
<td>• Standardized work</td>
<td>• Error proofing (poka-yoke)</td>
</tr>
<tr>
<td>• Pull of raw material</td>
<td>• Point of use storage</td>
<td>• Continuous improvement</td>
<td>• Continuous</td>
<td>• Streamlined layout</td>
<td>• Automation (jidoka)</td>
</tr>
<tr>
<td>• Multifunctional teams</td>
<td>• Quality at the source</td>
<td>• SS</td>
<td>• Management</td>
<td>• Pull/Kanban</td>
<td>• Continuous improvement (kaizen)</td>
</tr>
<tr>
<td>• Decentralization</td>
<td>• Teams</td>
<td>• Value stream mapping</td>
<td>• Admission</td>
<td>• TIMING (5S)</td>
<td>• Change management</td>
</tr>
<tr>
<td>• Integration of functions</td>
<td>• Pull/Kanban</td>
<td>• Just-in-time (JIT)</td>
<td>• Small lot size</td>
<td>• Shopfloor organization (5S)</td>
<td>• Takt time</td>
</tr>
<tr>
<td>• Vertical information systems</td>
<td>• Continuous</td>
<td>• Error proofing (poka-yoke)</td>
<td>• Multi-function</td>
<td>• Material 'pull' system</td>
<td>• Total productivity maintenance (TPM)</td>
</tr>
<tr>
<td>• Elimination of waste</td>
<td>• Zero defects</td>
<td>• Quality at the source</td>
<td>• Preventive</td>
<td>• Overall equipment effectiveness (OEE)</td>
<td>• Kaizen blitz’ events</td>
</tr>
<tr>
<td>• Continuous improvement</td>
<td>• Just in time deliveries</td>
<td>• Teams</td>
<td>• Preventive</td>
<td>• Total productivity maintenance (TPM)</td>
<td>• Value stream mapping (VSM)</td>
</tr>
<tr>
<td>• Zero defects</td>
<td>• Pull of raw materials</td>
<td>• Pull/Kanban</td>
<td>• Visual controls</td>
<td>• Automatic line stop when parts</td>
<td>• Process mapping</td>
</tr>
<tr>
<td>• Just in time deliveries</td>
<td>• Multifunctional teams</td>
<td>• Quality at the source</td>
<td>• Visual controls</td>
<td>• defective (jidoka/autonomation)</td>
<td>• Cellular manufacturing</td>
</tr>
<tr>
<td>• Pull of raw material</td>
<td>• Application of preventive maintenance</td>
<td>• Teams</td>
<td>• Visual controls</td>
<td>• Policy deployment</td>
<td>• Quality function deployment (QFD)</td>
</tr>
<tr>
<td>• Multifunctional</td>
<td>• Continuous improvement (kaizen)</td>
<td>• Pull/Kanban</td>
<td>• Visual controls</td>
<td>• Change over reduction (SMED)</td>
<td>• Multipurpose handling</td>
</tr>
<tr>
<td>• Quality at the source</td>
<td>• Change management</td>
<td>• JIT</td>
<td>• Visual controls</td>
<td>• Process mapping</td>
<td>• Six sigma</td>
</tr>
</tbody>
</table>

The approach taken by lean manufacturing should include the results of improvement in the operational process and internal management aspects such as pull systems, short cycle times, visual management, higher quality, less inventory, total quality management, just in time and total productive maintenance [33, 34], Karlsson and Ahlstrom (1996) [35] indicated the lean manufacturing characteristics, namely: elimination of waste, continuous improvement, zero defects, just-in-time, pull of materials, multifunctional teams, decentralization, integration of functions, and vertical information systems.

According to Kaplan and Norton (2001) [36], the inclusion of customers is very essential in company strategy in order to achieve success. Sousa (2003) [37] argued that customers’ needs and satisfaction, as well as internal processes should be linked to efforts aimed at improving the outcome of a company’s performance. Gunasekaran et al. (2004) [38] stated that in order to keep customers satisfied, the company should have a system of fast and accurate responses. The two variables, customer complaints and on time delivery, have been significantly linked to both company strategy as well as the measurement of manufacturing performance [39] (Ahmad and Dhaif, 2002).

Other lean activities related to customers’ issues are product quality, guarantee and warranty, product cost, product customization and the number of certified suppliers. Supplier performance also plays an important role in lean manufacturing activities (improvement of the links and co-ordinations between a company and its suppliers). Levy (1997) [40] stated that involving suppliers in Just-In-Time (JIT) delivery and low inventory, for instance, are very crucial in the lean manufacturing process. Duffie and Helper (1997) [41] went further to suggest that requirements of being a lean supplier include: high quality and cost reductions, having a rapid response system, and efficient inventory systems fit for the global market. Owen and Kruze (1997) [42] found that motivating a supplier to apply just-in-time could reduce costs, improve quality and delivery to customers.

Learning and training of employees can result in improvement of products and processes, which are fed back into the company. In addition, giving feedback to employees can also improve their performance by giving the right information and motivation, while also providing a sense of accomplishment (Dumond, 1994) [43]. Learning in terms of developing new technologies could increase efficiency and decrease cost of manufacturing will lead to improvement in the company’s financial outcomes [44] (Bassioni et al. 2004).

One of the key characteristics for successful implementation of lean manufacturing is the respect for people. Kim and Takeda...
Other essential characteristics of a lean company include the company’s future such as investments and Research and Development (R&D). In terms of improving productivity and competitiveness, the challenge is for manufacturing companies to apply their innovation and creativity to improve their company’s performance to face the future. They also have to introduce new technology, high quality products, new marketing strategy and commercialisation for gaining higher profits, investment and growth. According to Morbey (1988) [48], investment in R&D has the potential to impact growth, competitiveness and future achievements of a company. Therefore, the development of a lean manufacturing should focus on the company’s R&D in order to stay competitive. In contrast, Nixon (1998) [49] argued that R&D costs can increase due to dependence of the company on technology. Consequently, a company’s investors and top management would keen to measure R&D performance effectively. Therefore, the R&D is an important indicator in lean product development (Frattini et al. 2007) [50] and it has significant relationship with investment priority.

Investing in market research is another important indicator for improving products of lean manufacturing and investing in the future. Moreover, an important indicator of the future of company is investment in advertisement. Advertisement is one of the best ways to promote existing and new products, which then leads to market growth. Because of the dynamic nature of market environments, a manufacturing company should have capability to improve their internal and external competences if they are to improve the company’s performance. In order to improve their internal and external competences, a lean company can focus on investment in automation processes and procurement of new machinery.

Automation of processes can reduce manual effort; enhance process performance to achieve the company’s manufacturing level for the success of a manufacturing company. Kotha and Swamidass (2000) [51] stated appropriate automation can positively affect the performance of a manufacturing company. Meanwhile Hill (2000) [52] also argued that automation decisions can support a company’s expectations but more importantly, to make decision for selection of investment in the automation. By measuring the level of investment in automation, a company can make better decisions regarding a variable that has potential to improve manufacturing performance, competitiveness and support of overall performance of the company.

Yet, the implementation of automation in manufacturing can affect employees by necessitating further training to advance their range of skills. Consequently, the company would need to pay attention to investing in the training of employees. Kraiger (2003) [53] argued that companies which spend more on training and development of their employees tend to be more successful than those which do not. Salas et al., (1999) [54] also observed that investing in training and development programs can lead to improvement in a company’s performance. As a result, it is essential for companies to be able to measure their investment in training of employees in order to assess the extent of improvement and potential of achievement.

### 4.0 IMPLEMENTATION OF LEAN MANUFACTURING IN INDONESIAN SMEs

Some case studies of lean manufacturing implementation in Indonesian SMEs by several authors are presented in Table 2. The results from this survey literature showed that the lean manufacturing approach described in this paper is indeed applicable in the context of Indonesian SMEs. The main findings by the case studies include observed and measurable improvements as the result of adopting the lean manufacturing approach.

Moreover, however, were some barrier to introduction lean manufacturing approach to the Indonesian SMEs such as a lack of management support, a lack of financial support, resistance to change in companies’ production processes and internal business, and a lack of skilled employees.

Moreover, the result of this research also reveals that although there are potentially more lean manufacturing implementations within the Indonesian SMEs manufacturing sectors, there are only few publications. Although the various case studies presented showed positive correlation between lean manufacturing implementation and improvements in performance, the presented cases constitute a relatively small sample and hence more research in this area is required.

<table>
<thead>
<tr>
<th>Authors</th>
<th>Case study description</th>
<th>Lean manufacturing approach (tools and techniques)</th>
<th>Main findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Misbah et al. (2015) [55]</td>
<td>Minimize the non value added activities in furniture products (learning chair)</td>
<td>Value Stream Mapping (VSM), value stream analysis tools (VALSAT) and failure mode and effects analysis (FMEA)</td>
<td>• Based VSM identified the waste occurring in the production process of learning chair (from the most to less) is defects, waiting time, unnecessary inventories, transportation, overproduction, inappropriate processing, unnecessary motion, environment healthy and safety, and underutilized people. • There was a decline of lead time of 20.27% in the production process.</td>
</tr>
<tr>
<td>Noviayars and</td>
<td>Reorder the work area of Six-sigma and 5S</td>
<td></td>
<td>• The production process increased from 11.4 hours/unit to 10.5 hours/</td>
</tr>
</tbody>
</table>

Table 2: Lean manufacturing approach as a case study by several authors
Sethiawati (2014) [56] Thresher machine product to improve the production process in manufacturing of agricultural equipment. (Sort, Set in Order, Sustain, Standardise and Shine) unit (improve 7.5%).
- There was efficiency in cycle time of the production process of 84%, as a result of the reduction in time to minimize the non value added activities.

Raliby (2014) [57] The 5S implementation becomes a work culture in the Craft Industry and an effort to gain CE-MARK certification. 5S
- The level of education was quite significant influence to understanding and applying the 5S culture.
- The implementation of 5S program was quite effective in the case study company.
- The management commitment and active participation of employees were a key success in implementing 5S program for craft industry.

Harisupriyanto (2013) [58] Identification value of overall equipment effectiveness, wastes, and determines policy alternatives to improve the quality and production capacity in the processing of food (snacks from raw cassava). Value Stream Mapping (VSM), 5S, and Root Causes Analysis (RCA)
- Based VSM identified the waste occurring in the production process was waiting, defects, and excessive motion.
- Overall equipment effectiveness value was 0.6357 (very high losses).
- Alternative policies to improve the quality and production capacity were the provision of aids, the stroller to carry cardboard, employee training, and procurement of the oil reservoir system tools to ease the process of pouring the oil.

Muchtiar et al. (2007) [59] Implementation of lean six sigma and 5S in process production of bolt and nuts. Lean six sigma and 5S
- Based value stream mapping indicated the improving of the production cycle time from 74.57% to 78.04% for the bolts, and nuts from 64.60% to 70.21%.
- The value of bolt in term of process capability revealed very low, which was 0.416. Then, it can be interpreted the production processes unable to achieve quality target and conducted rework by the operator.
- The value of six sigma for upper control limit and lower control limit were 1.53 and 1.63 respectively (it was not stable).
- Hence, by implementing of 5S can minimize waste such as time to search tools, the waiting and transport time due to the work area and equipment neatly arranged and put in place a clear and definite.

5.0 CONCLUSION
This paper discussed the introduction and implementation of lean manufacturing tools and techniques to improve the productivity of the enterprises as well as the management systems in the Indonesian manufacturing industries, especially for the SMEs.

The SMEs may differ in areas such as size, technology, people culture, complexity, environment, etc. Therefore, in order to introduce the lean manufacturing system for the Indonesian SMEs, it is important to identify their areas of concern based on specific characteristics of the individual companies. These can then be accurately represented and modeled for an optimum solution. Based on the characteristics of lean manufacturing within the Indonesians SMEs, the areas of likely concerns are: customer issues; supplier issues; manufacturing and internal business; research and development; learning perspective; and investment priority. Individual companies can then implement specific lean tools and techniques that suit their business cultures.

Future work based on this research can be developed as a framework for introducing lean manufacturing in term of a set of regular operations as currently employed in the Indonesian SMEs. This framework will then be able to assist individual SMEs to select a suitable lean manufacturing tools and techniques without the need to go through extensive consultations and work.

REFERENCE


