Awareness, implementation, effectiveness and future use of lean tools and techniques in Malaysia organisations: a survey

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Abstract. This paper presented the results of awareness, implementation, the level of effectiveness, and potential future use of ten lean tools and techniques based on Malaysian organisational context. The ten lean tools and techniques being studied include 5S, Cellular Manufacturing (CM), Kaizen, Poka-Yoke, Standardised Work (SW), Value Stream Mapping (VSM), Jidoka, Kanban, Plan-Do-Check-Act (PDCA), and Total Productive Maintenance (TPM). This study was conducted due to the lack of existing studies on the current status of awareness, implementation, effectiveness, and future use of lean tools and techniques in Malaysia. An online survey was conducted for this study. The survey was distributed via email to 320 practitioners, managers, executives, consultants, and academicians who have been involved in the selection and/or implementation of lean tools and techniques. A total of 102 responses were returned from 320 industries resulting in 31.9% of valid response rate including responses after follow-up email. Data were analysed using the IBM SPSS software package. The findings indicated 5S as the most popular lean tool, followed by Standardised Work (SW), and Kaizen for Malaysian organisations based on the awareness, implementation, effectiveness, and future use of lean tools and techniques.

1. Introduction
Nowadays, in order to be competitive in the current globalisation, the manufacturing industry is facing many challenges such as inconsistent customer demand, rising customer expectations, and competition in the market. Therefore, large firms and SMEs need to embrace the changes and improvements in their key activities and/or process in order to cope with the challenges [1]. In general, large firms are more compelled to do so compare to the SMEs due to the fact that they are more influential with better organisational management and have good financial stability compared to the SMEs. Many small businesses do not perceive their own environmental impact as significant compared to those of larger firms [2]. Many industries have started to turn to the lean principles to elevate the performance of their firms in order to become profitable. The lean production is most frequently associated with the elimination of the seven important wastes to ameliorate the effects of variability in supply, processing time or demand [3].

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2. Lean tools and techniques

Lean production is also known as manufacturing without waste. In this case, the waste consists of the non-added value to the product. There are seven types of waste which are overproduction, waiting time, transportation, inventory, inappropriate processing, excess motion, and product defects [4] – [6]. Lean Production is one of the improvement initiatives that can be implemented to achieve business excellence [7]. Current studies show that there are more than 50 lean tools and techniques that are being used widely, depending on the size of the industries [8]. In Malaysia, a variety of studies were found to be related to lean production tools and techniques adoption and implementation especially in the automotive [9] – [11], electrical and electronic [1] and food and beverage industries [12] in order to achieve higher performance improvement. Based on the pilot study, ten main lean tools and techniques have been identified via expert interviews which include: (1) 5S (Housekeeping), (2) Cellular Manufacturing (CM), (3) Kaizen (Continuous Improvement), (4) Poka-Yoke (Mistake Proofing), (5) Standardized Work (SW), (6) Value Stream Mapping (VSM), (7) Jidoka, (8) Kanban, (9) Plan-Do-Check-Act (PDCA), and (10) Total Productive Maintenance (TPM).

3. Research design and methodology

3.1 Questionnaire design and validation

The questionnaire was designed using close-ended questions in order to make ease of answering. For the current usage and future adoption of lean tools and techniques a dichotomous ‘yes/no’ answer was used, whilst for the awareness and effectiveness of the lean tools and techniques, an ordinal scale of ‘don’t know/very low/low/moderate/high/very high’ was used. Respondents were requested to only answer questions that were relevant to their usage (or non-usage) of the tools and techniques. For example, only organisations that used the tools and techniques could rate their level of effectiveness. As suggested by [13], in order to further minimise the potential misinterpretation of the lean tools and techniques across the various states, the researchers ensured a definition for each lean tool and technique was displayed within the questionnaire. After pilot test had been done, the comment and feedback from experts on the subject were analysed and a few minor corrections were made to improve the instrument. The reliability of the questionnaire was checked using Cronbach’s alpha coefficient to measure the internal consistency of the research instrument. According to [14], the reliability measurement is an indication of the stability and consistency of the instrument. Generally, the agreed value for the lower limit for Cronbach’s alpha is 0.70, but it could be as low as 0.60 in exploratory research [15]. The elements of lean tools and techniques were tested for the internal consistency using SPSS reliability analysis procedure. For this study, the results showed that the survey instrument was reliable and had a high internal consistency with the Cronbach’s alpha value of 0.853, which was ≥ 0.70.

3.2 Sampling, questionnaire distribution and analysis

Samples of this study were obtained from the Malaysian Productivity Corporation (MPC) and Federation of Malaysian and Manufacturers (FMM) databases. The respondents involved in this study consisted of directors, managers, engineers, executives, and academicians. The respondents were considered as the best candidates to answer the survey because they were directly involved in the process. The data collection method of the study was random sampling. Before the questionnaires were distributed, they were translated from Microsoft word to the online version using the Google documents (www.google.com). The online questionnaires were distributed through email invitations. The IBM SPSS Statistics software package was used to analyse the questionnaire responses.
4. Results and discussion

4.1 Profile of the respondents

Based on the total of 320 candidates, only 102 respondents completed the online questionnaires, resulting in 31.9% of valid response rate including responses after the follow-up emails. Most of the respondents involved in the study had at least five years or more experience related to the area of quality and productivity, which yielded 61% from the total respondents, followed by one to two years of experience (16%). Meanwhile, respondents with three to four years of experience and those with less than one year of experience yielded 13% and 10%, respectively. In terms of work position, almost half of the respondents were in the executive/engineer level, which yielded about 44%. Meanwhile, 32% of respondents were in the level of General Manager, Senior Manager, Manager or Assistant Manager. The rest of the respondents were Chief Executive Officer, Director, President or Vice President (13%), Academician or Researcher (7%), Specialist or Consultant (2%), and Supervisor or Team Leader (2%). The findings of the current lean maturity level showed that 53% of the respondents' organisations were in the progressing level (53%), followed by matured (27%), and at the beginning level (20%). Other than that, it was also found that the majority of respondents worked with large organisations (57%) and the rest of them (43%) worked with SMEs.

4.2 Survey results

In the questionnaire, the respondents were asked to rate their level of awareness and effectiveness of lean tools and techniques using the Likert scale (0 – do not know, 1 - low, 2 - very low, 3 - moderate, 4 - high, 5 – very high). The respondents were also asked to answer "Yes" or "No" to indicate the status of the implementation and potential future use of lean tools and techniques. The results of all ten lean tools and techniques were then analysed while the lean tools and techniques were ranked based on the mean value and percentage of "Yes". Figure 1 shows the awareness level of lean tools and techniques by the Malaysian organisations. 5S was ranked the highest with the mean score of 3.75. The second was Standardised Work (3.64), followed by Kaizen (3.55), PDCA (3.38), TPM (3.10), Poka-Yoke (2.94), Kanban (2.82), CM (2.72), VSM (2.65), and Jidoka (2.59). From the results, it can be seen that most of the Malaysian organisations were aware of 5S and they understood the concept of 5S in order to help to reduce waste successfully. Moreover, 5S is also known as the basic tool for implementing lean.
The findings for the implementation status of lean tools and techniques in Malaysia (figure 2) showed that 5S and SW were at the highest ranking with 85% of respondents implemented them at their organisation. The second in rank was PDCA (80%), followed by Kaizen (71%), TPM (62%), Poka-Yoke (60%), CM (55%), VSM (51%), and finally, Kanban and Jidoka which attained the same percentage (49%).

![Implementation of Lean Tools and Techniques](image)

**Fig 2.** Implementation status of lean tools and techniques in Malaysia.

Figure 3 shows the effectiveness of the ten main lean tools and techniques. 5S was the most effective lean tool with the mean score of 3.56. Kaizen while SW was the second in the rank with the mean score of 3.46, followed by PDCA (3.39), TPM (3.17), Poka-Yoke (3.03), Jidoka (2.87), CM (2.85), VSM (2.79), and Kanban (2.72).

![Effectiveness of Lean Tools and Techniques](image)

**Fig 3.** Effectiveness level of lean tools and techniques in Malaysia.
The findings for future use of lean tools and techniques (figure 4) showed that 5S was the most wanted lean tool with the percentage of "Yes" at 97%, followed by Standardised Work (95%), Kaizen (93%), PDCA (90%), TPM (85%), Poka-Yoke (80%), VSM (80%), Jidoka (78%), CM (75%), and Kanban (72%).

![Future Use of Lean Tools and Techniques](image)

**Fig 4.** Potential future use of lean tools and techniques in Malaysia.

5. **Conclusions**
This study investigated the level of awareness, usage, level of effectiveness, and future adoption of lean tools and techniques in Malaysia organisations. The results show that 5S, Standardized Work and Kaizen are the most popular lean tools and techniques in Malaysian organisations. The results of the study had important managerial implications especially for the managers. It is important for managers to know the current level of awareness for lean tools and techniques based on their nature of business in order to help them to adopt and consequently, improve their knowledge of lean tools and techniques that are lacking. These findings could also help Malaysian Productivity Corporation (MPC) and also Federation of Malaysian Manufacturing (FMM) to plan, prepare, and conduct training for Malaysian organisations to adopt the related lean tools and techniques in the near future.

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