FACTORS INFLUENCING SELECTION OF LEAN TOOLS AND TECHNIQUES IN MALAYSIAN ORGANISATIONS

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ABSTRACT: This paper attempts to evaluate 16 factors that should be considered when selecting lean tools and techniques. Lean tools and techniques are typically used to eliminate waste that are produced by defects, waiting time, overproduction, extra motion, extra processing, excess inventory, and unnecessary transportation. The study was conducted in the form of a survey, with data being gathered via purposive sampling. The respondents were chosen based on their involvement in the selection and/or implementation of lean tools and techniques in Malaysia organisations. The respondents were made of practitioners, managers, engineers, executives, consultants, and academics. The surveys indicated that there are ten factors with high agreement levels (>=4.00). These include: (1) Top management's approval and support, (2) Possible benefits gained after implementation, (3) Aligned with the organisation's vision, mission and purpose, (4) Aligned with the organisation's strategic plan and goals, (5) Prove of benefits from other similar organisations, (6) Allocation of resources, (7) Workforce capability, (8) Suitable with the organisation's culture, (9) Suitable with the organisation's maturity level, and (10) Suitable with the customers' and stakeholders' expectations or requirements. It is hoped that this research will assist organisations in selecting the most appropriate lean tools and techniques to be used in waste reduction.

KEYWORDS: *Lean Tools and Techniques; Selection Factors; Waste Reduction*

1.0 INTRODUCTION

In the manufacturing sector, the term lean production has been used to describe a manufacturing process relies on the ideas of delivering value from the customer's perspective, continuous improvement and eliminates waste or no waste. In this paper, the waste is considered as the by-product with no added-value. The seven sources of waste are overproduction, waiting time, transportation, inventory, inappropriate processing, excess motion, and product defects [1–3]. The most commonly cited benefits related to lean production practices are improvement in labour productivity and quality, along with reduction in customer lead time, cycle time and manufacturing cost [4].

Recent evidence suggests that there are more than 50 lean tools and techniques that are frequently practiced, depending on the size of the industries [5]. In Malaysia, the implementations of lean tools and techniques have been explored in several studies. These researches are condensed in the automotive [6–8], electric and electronic [9], and food and beverage industries [10], in the hope of increasing productivity. It should be noted that each lean tools and techniques has its own purpose, strengths, and limitations [11-12]. Assuming the methods to be fully comprehensive would be disadvantageous as the lean tools and techniques chosen should be tailored to the existing situation.

This study is important because each organisation has their own strength and limitation in order to select an appropriate lean tools and techniques to be implemented. There are a few factors that influence them in the selection of lean tools and techniques. To avoid unnecessary waste and frustration, it would be better for an organisation to select the appropriate lean tools and techniques that will fit with organisation's context and provide value to the organisation [11, 13]. Some organisation misapply the lean practices and the main reason for this scenario lies in their internal issues such as the lack of knowledge and their understanding of lean, cultures, lack of skills and so on, leading them to use the wrong lean tools and techniques to solve a problem, use the same tool to solve all of the problem, and use the same set of tools on each problem [14-15].

Therefore, the decision makers in an organisation should take into account all the variables of a situation before implementing any lean tools or techniques [12, 16]. Some of these variables are shown in Table 1.

Table 1: Several contingency factors of lean tools and techniques selection

Factors of selection	Authors
1. Ability to gain approval and support from top management (TM).	[11, 13, 17-18]
2. The capability of the workforce to execute the lean tools and techniques (WF).	[11, 13, 18]
3. Whether the lean tools and techniques agrees with the vision, mission and/or purpose of the organisation (VM).	[13, 18]
4. The suitability of the lean tools and techniques with the organisation's maturity (ML).	[11, 19-20].
5. The availability of resources such as funding and resources to execute the chosen lean tools and techniques (RA).	[11, 21]
6. The implementation of lean tools and techniques follows the direction, strategic plan and/or goals of the organisation (DS).	[11, 13, 18]
7. The implementation of lean tools and techniques will fulfil the customers' and other stakeholders' prospects (CS).	[16]
8. The suitability of the lean tools and techniques with the organisation's work culture (OC).	[13, 18, 22]
9. The lean tools and techniques' agreement with the political, economic, social, technological, legal and environmental factors of the society (EE).	[11, 13, 18]
10. The competency of the lean tools and techniques with the types of sector/industry that the organisation operates in (such as private, public or non-profit) (TS).	[11, 13, 18–20]
11. The implementation of lean tools and techniques suits the organisation's size (e.g. small, medium or large) (SO).	[13, 18, 19]
12. The difficulty level of performing the chosen tools and techniques (EI).	[11]
13. The benefits of adapting the chosen lean tools and techniques (BI).	[13, 18, 23]
14. The time taken to benefit from the lean tools and techniques (DT).	[16]
15. Prove of benefit from similar organisations that adapted such lean tools and techniques (PV).	[16]
16. The areas for the lean tools and techniques to be implemented (e.g. Based on types of waste) (AI).	[17, 24]

2.0 METHODOLOGY

The data in this research were collected through self-administered questionnaires. These questionnaires were prepared based on the work of Mohammad [13] and Mohammad et al. [12]. The introductory page provided the respondents with the researchers' background and contact details. This page also describes the characteristics of potential

respondents, the purpose of the survey, the estimated time taken to complete the questionnaires and the benefits of participating in the survey. Meanwhile, Section 1 elicited general information regarding the respondents and their organisation. Section 2 was designed to ascertain the respondents' view on the variables that should be taken into account when choosing lean tools and techniques. Section 3 was constructed in a way that will allow us to measure the respondents' judgement on the relationship between lean tools and techniques, and types of waste. It should be noted that this paper will only present the results from Section 2.

In this research, purposive sampling was used. Purposive sampling can be described as a "selection of individuals/groups based on specific questions/purposes of the research in lieu of random sampling and on the basis of information available about these individuals/groups" [25]. Moving on, purposive sampling in this research included practitioners (70%), consultants (20%) and/ or academicians (10%). This cohort was made of those who have been involved in the selection and/or implementation of the lean tools and techniques in their organisation. They were chosen based on their knowledge and/or experience in the selection and/or implementation of lean tools and techniques [12]. Ten respondents completed the survey, and 90% of the respondents have at least five years of experience in the quality, productivity and/or operation improvement field. Note that a respondent who completed the survey was assumed to consent to their data being used in this research. The Details of respondent's background are shown in Table 2.

In Section 2, the questions asked participants to rate how strongly they agreed with each statement. Using 5-point Likert scale, the scales were required to rate 16 factors that should be taken into account when choosing lean tools and techniques. The scale ranges from 1 (Strongly Disagree) to 5 (Strongly Agree). The results were then analysed using the SPSS software to calculate the mean and standard deviation of the data.

Table 2: Respondents profile

No	Designation	Types of industries	Qualification	Work experience and achievement
1	Academician	Education	Doctor of Philosophy (Manufacturing Engineering), University of Birmingham, United Kingdom.	Has involved in the Lean Project for more than 9 years.

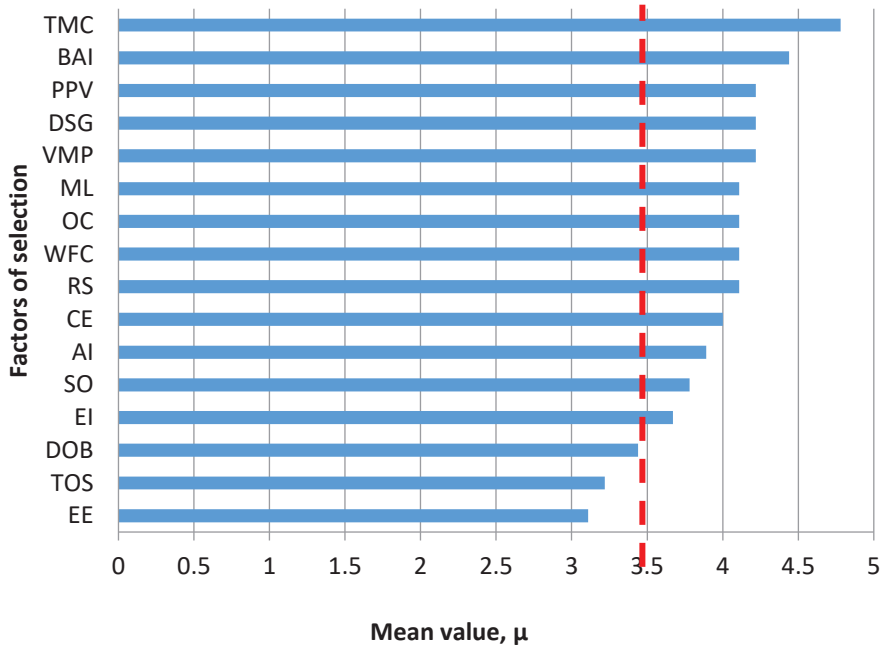
2	Consultant	Services	Bachelor of Engineering (Mechanical Engineering), UTM, Industrial Engineering.	Has involved in the Lean Project for more than 13 years in quality and reliability manager and 11 years in consultation in lean implementation.
3	Consultant	Services	Master in Information Management.	Has involved in productivity and quality improvement activity and handling almost 20 Lean Project start from 2014.
4	Assistance Manager	Manufacturing	Bachelor of Engineering (Mechanical -Industrial).	Has involved in quality and productivity more than 7 years.
5	Kaizen and Planning Manager	Manufacturing	Bachelor of Engineering (Industrial Engineering).	Has involved in the area of Quality and Productivity for more than 24 years.
6	General Manager	Manufacturing	Bachelor of Engineering (Mechanical -Industrial).	Has involve in quality and productivity improvement and lean journey more than 16 years.
7	Manager	Manufacturing	Bachelor of Science (Industrial Engineering).	Lead the Lean Manufacturing projects for more than 16 years Awarded with '3 Star Gold' award for both projects.
8	Engineer	Manufacturing	Bachelor of Mechanical Engineering.	Has involved in quality and productivity improvement more than 5 years.
9	Engineer	Manufacturing	Bachelor of Mechanical Engineering. Lean Black Belt.	Has involved in quality and productivity improvement more than 5 years.
10	Production Assistant Manager & Lean Lead Navigator	Manufacturing	Bachelor of Engineering (Electric, Electronic and System) Certified In Lean LPS Audit 2015.	Has involved in the Lean Project for more than 9 years Specialist Skills In Continuous Improvement, Lean And World Class Manufacturing To Increase Efficiency Reduce Waste And Losses Due To Downtime.

3.0 RESULTS AND DISCUSSION

This section presents the analysed data and evaluates them. Figure 1 shows the survey results and demonstrates the ten factors that have 4 and 5 ratings. The factors were ranked as follows:

i. The possibility of gaining the approval from top management to introduce and implement the lean tools and techniques successfully (μ = 4.78, SD =3.03).
ii. The benefits of implementing the lean tools and techniques (μ = 4.44, SD = 0.71).
iii. The selection and implementation of lean tools and techniques are aligned with the vision, mission and/or purpose of the organisation (μ = 4.22, SD = 3.54).
iv. The selection and implementation of lean tools and techniques are aligned to the direction, strategic plan and/or goals of the organisation (μ = 4.22, SD = 3.54).
v. The implementation of lean tools and techniques has been proven to provide value/benefit in other similar organisations (μ = 4.22, SD = 3.54).
vi. The ability to allocate the necessary resources to introduce and implement the lean tools and techniques successfully (e.g. funding and equipment) (μ = 4.11, SD = 4.95).
vii. The capability of the workforce to introduce and implement the lean tools and techniques successfully (μ = 4.11, SD = 4.95).
viii. The implementation of lean tools and techniques fits the organisation's culture (μ = 4.11, SD = 2.65).
ix. The implementation of lean tools and techniques is suitable for the level of organisational excellence maturity (μ = 4.11, SD = 2.65).
x. The implementation of lean tools and techniques will satisfy the requirements/expectations of the customers and other stakeholders (μ = 4.00, SD = 3.46).

Meanwhile, there were three factors that were close to scoring 4. These were the areas of implementation, the size of the organisation and the difficulty of adapting. The time taken to benefit from the lean tools and techniques, the sector/industry that the organisation operates, and the external environment that the organisation operates in were rated less than 3.5 which is closely disagreed.



Legend:			
TMC	Approval from top management.	ML	Level of organisational excellence maturity.
BAI	Benefits after implementation.	CE	Requirements / expectations of the customers.
VMP	Align with vision, mission and/or purpose of the organisation.	AI	Areas of implementation.
DSG	Align to the direction, strategic plan and/or goals of the organisation.	SO	Size of organisation (such as small, medium or large).
PPV	Value / benefit in other similar organisations.	EI	Easy to implement.
RS	Resources (e.g. funding and equipment).	DOB	Duration taken to obtain the benefits.
WFC	Capability of the workforce.	TOS	Types of sector / industry (private or public).
OC	Fits the organisation's culture.	EE	External environment (political or economic).

Figure 1: The survey results of factors of selection

The results of this research support the work of other studies in this area concluded that the top management's commitment is the most important factor for the selection of the lean production tools and techniques [13–15]. Failure to gain top management's approval will affect budget allocation for the initiative [5]. Second-in-ranking was the possible benefits of implementing such an approach. It is

pertinent for the decision makers to hypothesise the possible benefits that the company will gain from the selected lean tools and techniques [11, 13, 18]. Furthermore, the third most important factor was related to the organisation's vision, mission and/or purpose [11, 13, 18]. Adapting new approaches without taking this factor into consideration will affect the performance of an organisation through the depletion of resources and lack of direction.

4.0 CONCLUSION

The aim of the present research is to analyse the 16 factors that should be taken into account when selecting lean tools and techniques. There were ten factors with high ratings (>=4.00). These were: (1) Top management's approval and support, (2) Possible benefits gained after implementation, (3) Aligned with the organisation's vision, mission and purpose, (4) Aligned with the organisation's strategic plan and goals, (5) Prove of benefits from other similar other organisations, (6) Allocation of resources, (7) Workforce capability, (8) Suitable with the organisation's culture, (9) Suitable with the organisation's maturity level, and (10) Suitable with the customers' and stakeholders' expectation or requirement. These are ranked according to the level of importance. Based on rational decision making, all of the factors discussed in this paper can be adopted by the organisations as decision criteria to assist in the selection of the most appropriate lean tools and techniques in order to avoid unnecessary waste and frustration. In this study, we found that in Malaysian organization, the ability to gain approval and support from top management, benefits after implementation, and align with organization vision, mission and purpose, are most three important factors that should be considered in selecting lean tools and techniques. This paper has provided professional insights into the selection of the most appropriate lean tools and techniques. Organisations which use these data to assist them in selecting the right approaches may contribute value to their organisation [11, 18] and avoid unnecessary waste and frustration. A natural progression of this work is to develop a decision software tool that may help in the selection of lean tools and techniques based on the characteristics evaluated in this survey. It is hoped that this study will further the progression of waste elimination.

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