Implementing lean in Malaysian universities: Lean awareness level in an engineering faculty of a local university

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Abstract. Many academic articles were published in Malaysia promoting the goodness of lean in manufacturing and industrial sectors but less attention was apparently given to the possibility of obtaining the same universal benefits when applying lean in non-manufacturing sectors especially higher education. This study aims to determine the level of lean awareness among a local university’s community taking its Faculty of Engineering (FoE) as the case study. It also seeks to identify typical FoE’s staff perception on lean regarding its benefits and the obstacles in implementing it. A web-based survey using questionnaires was carried out for 215 respondents consisting of academic and administrative staff of the faculty. Statistical Package for the Social Science (SPSS) was used to analyze the survey data collected. A total of 13.95% of respondents returned the forms. Slightly more than half of those responded (56.7%) have encountered some of the lean terms with mean 1.43 and standard deviation 0.504. However, the large amount of standard deviation somewhat indicates that the real level of lean awareness of FoE as a group was low. In terms of lean benefits, reduction of waste was favored (93.3%) by the respondents with mean 0.93 and standard deviation 0.254. For obstacles in implementing lean, lack of knowledge was selected by most respondents (86.7%) to be the major factor with mean 0.87 and standard deviation 0.346. Through the analysis done, the study may conclude that level of lean awareness among the university’s community was low thus may hinder implementation of lean concept.

1. Introduction
Manufacturers always strive to overcome challenges such as soaring customers’ expectation for the speed of service, better product quality, and flexibility – all at a lower cost to cope with unstable demand and intense competition in markets. Non-manufacturing sector is similar with manufacturing sector where they still need to serve customers. This paper focuses on lean implementation in non-manufacturing sector namely, higher education (HE). Emiliani [1] revealed HEs are facing the obstacle to giving worthwhile educational service while maintaining everything at affordable cost. Lean concept was developed in Japan to surpass the limitation of mass production and to shorten customers’ waiting time by means of waste elimination and application of continuous improvement [2]. Compared to mass production, lean consumes less in everything [3].

To the best of our knowledge, studies on lean implementation in Malaysian HE were relatively scarce. In order to evaluate the suitability of implementing lean in local HE, a survey was administered to an engineering faculty of a local university to gauge how well its community was aware of lean, and
to assess the typical perception of the community on the benefits of lean and the challenges of implementing it.

2. Experimental procedures
In this study, the survey tool was adapted from Salem et al. [4] and research subject was Faculty of Engineering (FoE) at the chosen local university. Since the data were needed for the calculation of the awareness index, open-ended type of questions was avoided. Section A focused on respondents’ demographic while Sections B, C, and D focused on lean awareness and understanding in the faculty. Some questions were of multiple-response types. Section E attempted to identify respondents’ thought on lean implementation in HE with special reference to their faculty.

Sample size was calculated using a method developed by Krejcie and Morgan [5]. A total of 215 respondents were targeted consisting of academic and non-academic staff and questionnaires were distributed among them using online platform. No students were involved in this survey due to several shortcomings e.g. manpower shortage, time limitation, and budget constraint.

To ensure the reliability of the data and internal consistency of the test score, Cronbach’s alpha test was run. The survey attempted to measure three aspects (i.e. lean awareness, opinion on lean implementation advantages and opinion on lean implementation obstacles). According to Table 1 the value of Cronbach’s $\alpha$ is above 0.6 (i.e. 0.911, 0.617 and 0.6897). Pursuant to Nakamura et al., having 0.6 of Cronbach’s $\alpha$ value is rather satisfying but Nunnaly had a stance to say 0.7 is adequate for data reliability [8].

| Factors and indicators | Mean | Std. Dev. | Cronbach’s $\alpha$ |
|------------------------|------|-----------|---------------------|
| Fundamental on lean     | 1.43 | .504      | .911                |
| Opinion on lean         | 1.03 | .183      | .617                |
| Implementation advantages| .83  | .379      | .689                |

3. Results and Discussion
30 sets of the questionnaire were returned and found reasonable for data analysis representing a response rate of 13.95%. The response rate is low because only one technique of survey distribution i.e. web-based survey was used. However, a study by Nasuha Lee Abdullah et al. [6], using almost all possible methods i.e. hard copy mail, paid-service online survey and a lucky draw initiative, turned out to have only 7% of response rate. Wong et al. [3] reported a response rate of 12.6% using postal survey. A similar rate of 11.5% by Ahmed and Hassan [7] was also reported. Hence, the low feedback rate in survey research in Malaysia was not unusual.

Section A: Demographic
Table 2 displays the background of the respondents. Learning respondents characteristic helped in deciding how close the sample in replicating the total population [9]. It can be seen that only 13.3% were from non-academic staff and the remainder was academic staff.

Manufacturing and Material Eng. Dept formed the highest respondent with 30%. This may be attributed to the lean topic which is originally from Manufacturing Engineering syllabus. The only department not participating in this survey was Professional Engineering & Continuing Education (PEaCE) and for ‘other’, the respondent claims him/herself from the administration. 50% of the respondents had more than 10 years of working experience in the FoE while the rest are as in the table.

This survey investigates the number of years the respondent have been involved in engineering to indicate their maturity in the field. As forecasted, 20 out of 30 respondents are having more than 10 years of experience. With this, this study can somehow differentiate between different sub-groups.
Table 2. Profile of the respondents.

| a) Role in the FoE                      | No. of Respondent | Percent |
|----------------------------------------|-------------------|---------|
| Academic staff                         | 26                | 86.7    |
| Non-academic staff                     | 4                 | 13.3    |

| b) Department in the FoE               |                   |         |
|----------------------------------------|-------------------|---------|
| Biotechnology Engineering              | 5                 | 16.7    |
| Manufacturing & Material Eng.           | 9                 | 30.0    |
| Mechatronics Engineering               | 4                 | 13.3    |
| Civil Engineering                      | 1                 | 3.3     |
| Mechanical Engineering                 | 1                 | 3.3     |
| Department of Science in Engineering   | 3                 | 10.0    |
| Electrical & Computer Engineering      | 6                 | 20.0    |
| Other                                  | 1                 | 3.3     |

| c) Experience in the FoE               |                   |         |
|----------------------------------------|-------------------|---------|
| 0 - 4 years                            | 13                | 43.3    |
| 5 – 10 years                           | 2                 | 6.7     |
| more than 10 years                     | 15                | 50.0    |

| d) Experience with engineering         |                   |         |
|----------------------------------------|-------------------|---------|
| 0 - 4 years                            | 6                 | 20.0    |
| 5 – 10 years                           | 4                 | 13.3    |
| more than 10 years                     | 20                | 66.7    |

Section B: Overview of Lean

The first question in Section B was asking whether the respondents have ever heard about ‘lean’ or anything related to lean e.g. lean manufacturing or lean concept. Here, this study tries to adopt the principle of Fricke and Buehlmann [10] where respondents will be considered aware of lean if they happened to encounter any of lean vocabulary before. The result shows that 56.67% of the respondents claimed that they have heard about the term lean. Hence, according to [10], the community of the FoE should be aware of lean. However going through the analysis, the large standard deviation, 1.43 (Table 1) indicates that the real level of lean awareness in this study may still be low.

For those who answered the first question negatively were later asked in the next question whether they were interested to know more about lean and from the feedback, it seems that 11 (84.6%) out of 13 are interested to discover the knowledge of lean. This is a good sign since lean implementation in any organization normally begin with lean training or education first. Undergoing this ‘orientation phase’, the partakers get familiarization with lean thinking, equipped with lean tools, and most importantly understand the benefits of practicing lean [1].

Meanwhile, for those who have heard about lean were asked about their general understanding of the lean concept. Figure 1 shows the outcome of this inquiry.

![Figure 1. Lean Concept.](image-url)

For this question, the respondents were allowed to choose more than one answer. The result obtained shows the same trend with [4], where the highest percentage is “tools and techniques for cost reduction and for improving operations”. While the least chosen answer is “long term ‘cost cutting’ strategies”. It is likely that “long-term ‘cost cutting’ strategies” are not a major attraction among the
FoE’s staffs although it is a significant feature of a successful lean implementation. As suggested in [4], training is crucial on stressing the importance of this ‘element’ for preparing an institution for any lean transformations projects. Different finding was shown in [3] where ‘waste reduction’ was chosen the closest to lean concept. Still, both elements score the highest in this paper which leads to the deduction that this paper’s result may be practical.

Next, these respondents were asked about the type of lean principle they are familiar with (the answer could be more than one). Figure 2 shows the result. From the observation, the principle that scores the highest is “continuous improvement” followed by “elimination of waste” and “JIT”. The least is “zero defect”. From the result, it is important to note that, among the two principles with the highest scores, are the principles with naturally understood. People tend to choose words that are far more widely known than the one which are more ‘lean-specific’ [10].

![Figure 2. Lean Principle.](image)

Section C: Lean Waste

This section concentrates on respondents’ reaction toward lean waste. It is the screening type question where the first question was aimed to divide the respondents into categories, which is the one that aware about the term “lean deadly waste” and another one is the group of people who do not. To summarize, out of 30 responses, 24 (80 %) of them were never heard about lean waste. This ratio indicates the shortage in the aspect of lean thinking, concept, and culture in majority of the respondents in the FoE. This result is rather normal if we compare with [4] as they also have 75% of the respondents which are an industrial worker in Qatar who answer ‘no’ to the same type of question.

The 2nd and the 3rd question in this section both asked the respondents about their own perspective on what are those that contribute to waste in term of ‘lean’. Figure 3 concluded the response by those who claimed they never heard about “lean deadly waste”. This question can be answered by more than one answer.

![Figure 3. Response of respondents who are not aware of the lean deadly wastes.](image)
specific phrase to distinguish general waste and lean waste. They scored the lowest. Similar results are shown in [4] where “defect”, “over-production” and “over-processing” score 73%, 62.2% and 51.4% respectively which makes them the top three.

For those who answered Question 1 of this section affirmatively were asked to identify the type of lean waste that they are familiar with. The scores were all above 80% as in figure 4.

![Figure 4. Response of respondents are familiar of lean deadly wastes.](image)

With a high percentage of the vote for every element, this might give an insight that they actually have a deep understanding regarding lean. This claim might be supported by the fact that “motion”, “transportation”, and “inventory” have a really low vote in the previous section. Because, only the people that have a good understanding about lean know that all these three waste are as important as the others. In [12], where these researchers asked their respondents to rank which kinds of waste that lean eliminates in their respective organizations shows that “motion” and “inventory” comes second and third after “extra processing”. To see that lean practice is eliminating those elements mostly in their industries gave us a view that those wastes are worth to give an attention to. As said before only people with a good understanding with lean knows how much “motion”, “transportation” and “inventory” means as wastes. Tompkins et al. informed that transportation has a cost attribute to material handling about 15% to 18% (as cited in [8]). Likewise, Liker [13] said that excess inventories can be described as “evil” that hide problem. To conclude, with this level of result, it might be a good indicator for the faculty to kickstart the lean implementation.

Section D: Lean Tools & Techniques

The questions in this section intended to collect information specifically related to how much people in the FoE are aware of the lean tools and techniques that existed today. 66.7% of the respondents expressed the not knowing of the existence of any lean tools. While another 33.3% of the respondents were directed to ‘tick’ on any of the choices in the next question asking what type of lean tools they are familiar with. The outcome is illustrated in the following figure 5.

![Figure 5. Lean tools and techniques awareness.](image)
Based on the figure, the most popular tool is “5S” having 100% vote from all the 10 respondents. This result may be affected by the popularity of the 5S itself as it is used in most companies in Malaysia. Data in [3] and [4] also have similar finding where 5S dominates first. This proves that many companies in Malaysia are popular with 5S. In fact, 5S is the basic of lean manufacturing tool that you will use first to begin the lean implementation, where no one should fail practicing it [14].

The second most known tools based on the graph should be “PDCA cycle”, and “JIT”, followed by “TPM”, “Standard work” and “VSM”. This trend shows that the respondents have a basic or general knowledge about lean tools [4]. Noticed that the percentage are low for such tool like “SMED”, visual control and “cellular manufacturing”. There is an uncertainty regarding this situation either the area of research i.e. non-manufacturing, hence very little activities - nearly none, to expose the respondents about manufacturing sector activities give effect in this result.

Section E: Lean implementation in HE

The last section in the set of the survey questionnaire was conducted to collects information about respondents’ opinion on applicability in HE. Question 1 asked whether the respondents have faith in the possibility of implementing lean in non-manufacturing sector. 96.7% of the respondents seem to have the faith. Moving to the next question, it is to investigate either any of the respondents were ever been involved (as a part of the team) in the lean project. Interestingly, there are a few. Having 10% from the respondent that actually had been involved and have an actual real life experience is such an excitement because the application of lean in HE is still at the beginning level, especially in Malaysia (considering only few publications that actually touched about lean implementation in Malaysian HE has been found). It is supported by Langer [15] that said lean in university is still relatively new. Also, Ziskovksy, B. and Ziskovksy, J. [16] mentioned that the concept of lean management is not new except for education industry. Having some of the experienced people in the team is beneficial because according to University of Central Oklahoma, their first step to lean was outsourcing facilitator from a professional consultant agency to guide and facilitate their progress (as cited in [17]).

The remaining two questions were asking about the benefits that lean would bring to the organization and the challenges of implementing it with reference to their FoE.

From figure 6, 93% recognizes lean will reduce waste and 83% on “improved quality” (product and/or service) in the FoE. Whilst 73% of the responses indicate that the FoE would improve in productivity. The rest of the corresponding answers are shown in figure 6. What seems to be just a theory to these respondents, are actually the most practical in real cases. In [3], when they asked their respondents what has lean brings (i.e. benefits) to their company, “reduction in waste” and “improved productivity” got placed among the top. Waste minimization is still the major concern regardless the sector (i.e. manufacturing firms and service sector). Noted that since the subject of research is university, “decreased inventory” has the lowest vote. Different to the findings of other cases where the subject of study is industry i.e. [3], [4] and [8], “decreased inventory” get the proper attention as it should be.
Figure 7. Challenges of lean implementation.

Figure 7 is the most likable challenges to be in the way of implementing lean based on respondent’s thought. “Lack of knowledge” and “lack of management commitment” are the two most voted factors, 86%, and 83% respectively that ‘cross beam’ the successfulness of lean implementation. Since lean is a methodology that requires a long-term supervision, the fright of giving a commitment to it is always the factor blocking an organization from initializes lean [18]. Also, Scherrer-Rathje et al.; Worley & Doolen mentioned one of the success factors for the implementation is senior and middle management commitment (as cited in [16]).

The third highest factor (73.3%) acknowledge by respondents is “human factor.” This factor is supported in [3] where the major obstacles of applying lean in companies seem to be ‘people’ factor. People tend to work in the old ways probably because of the perception that lean may burden them with extra chores [3]. Furthermore noticed that “budget constraints” scored quite high in the data, this should contribute such problem if the FoE wants to implements lean later on in fact that the country is having such an economic issues right now. It is also one of the elements that contain high percentage in [3] and [8] where both types of research were done in Malaysia. “Scared of failure” seems not be an issue here since it scored the least vote by the respondents. Maybe this is due to the environment of an educational institute that is full of knowledgeable people.

4. Conclusion

From the data collected and analysis made real awareness of lean concept is somewhat low in the community of the engineering faculty of the chosen local university. Respondents have a general idea on what lean waste is, thus, ‘reduction of waste’ was perceived as the most important lean benefit. In terms of barriers to successful lean implementation, ‘lack of knowledge’ was perceived as the major factor.

To capitalize the benefits of lean in Malaysian higher education, achieving strong awareness and real understanding of the concept must be given the highest priority together with real commitment by the management. A success story of lean implementation in a local Malaysian higher institution of higher learning would really serve as an excellent approach to achieve this aim.

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