Investigation of the prominent barriers to lean manufacturing implementation in Malaysian food and beverages industry using Rasch Model

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Abstract. This paper presents a preliminary study on the prominent barriers to lean manufacturing implementation in Malaysian Food and Beverages Industry. A survey was carried out to determine the most prominent barriers of lean manufacturing implementation that are currently being faced in this industry. The amount of barriers identified for this study is twenty seven. Out of 1309 available organizations, a total of 300 organizations have been randomly selected as respondents, and 53 organizations responded. From the variable map, the analysis shows that, the negative perception towards lean manufacturing top the list as the most agreeable barrier, while the technical barriers came after it. It can also be seen from the variable map that averagely, lack of vision and direction is the barrier that is being faced. Finally, this is perhaps the first attempt in investigating the prominent barriers to Lean Manufacturing implementation in Malaysian food and beverages industry using Rasch Model.

1. Introduction
Food and beverages industry has been said as one of the critical industry in the world, since it involves raw materials and stringent requirements. As in Malaysia, Small and Medium Enterprises (SMEs) is the major player in the food and beverages industry, since they consists of eighty percent of the total establishment (1). This industry offers a very unique and a wide variety of products, for the culture differences between three major races in Malaysia, namely, Malay, Chinese and Indian. The food processing industry is primarily Malaysian-owned and it is anticipated that the present global retail sales in food products are worth around USD3.5 trillion, and are expected to grow at an annual rate of 4.8 percent to USD6.4 trillion by 2020 (2).

Despite of having a lot of potential and opportunity to expand the business, SMEs are having their own dilemma. Studies from various countries have proven that SMEs are vulnerable to compete with large companies (3–5). In order for them to be able to stay viable, a shift in paradigm and a new way of doing work is deemed. Lean Manufacturing has been proven as one of the management system that could help organizations to optimize the resources and eliminate waste. Lean Manufacturing has been widely implemented in the Malaysian automotive industry, as well as the electric and electronics industry (6–8). However, the status of Lean Manufacturing implementation in the Malaysian food and beverages industry is very scarce. It is learnt that only from year 2012; few studies had been conducted on the overall status of Lean Manufacturing implementation in the food industry (9–11). Even though
those studies provide meaningful analysis, it is worth to identify the challenges and barriers that hinder
the implementation of Lean Manufacturing in the Malaysian food and beverages industry.

Thus, the purpose of this study is to investigate the prominent barriers towards Lean Manufacturing
implementation in the food and beverages industry in Malaysia. This information is important as it
provides preliminary findings on organizations’ challenges in implementing Lean Manufacturing. The
analysis chosen for this purpose is by using Rasch Model. This paper is perhaps the first attempt, in
terms of analyzing data using Rasch Model, with respect to Lean Manufacturing implementation
barriers in Malaysia, specifically in food and beverages industry.

2. Literature review

2.1. Lean manufacturing

The term Lean Manufacturing was coined by Womack after his visit to Japan, to witness the
effectiveness of the Toyota Production System (TPS) in his book titled The machine that changed the
world (12). His five years of research acknowledged the importance of meeting customer needs and
adapting to changes in demand, through the implementation of Lean Manufacturing. Throughout the
years, researchers around the world have come up with their very own definition of Lean
Manufacturing. Sohal sees Lean Manufacturing as a working belief that does not necessitate
organizations to change to whole system, only to adjust it to suit their business culture (13). Radnor on
the other hand, defined Lean Manufacturing as a management practice based on the philosophy of
continuously improving processes by either increasing customer value or reducing non-value adding
activities (Muda), process variation (Mura), and poor work conditions (Muri) (14). However, it is
worth noting that every change is subjected to resistance, so does the change towards Lean
Manufacturing. This is very well confirmed by Kim in his study. He stressed that entrenched attitude
is one of the prominent cause on why the effort towards changes often failed (15). Khusaini in his
research has summarized the list of barriers which related to changes in Lean Manufacturing
implementation (16). Lack of top management commitment, lack of training, cultural change issues,
workers resistance to change are frequently quoted as the reason why Lean Manufacturing fails to be
implemented (16).

2.2. Lean manufacturing in Malaysian food and beverages industry

As mentioned earlier, large companies consist of only twenty percent of the total establishment in the
Malaysian food and beverages industry. The other eighty percent are SMEs which makes this industry
quite vulnerable to global competitors. To be able to compete, changes in the management system
should be taken care of. Lean Manufacturing is one of the management systems that could help SMEs
to optimize the usage of their limited resources. Barriers such as limitations in resources and
capabilities were said to be the obstacles for SMEs to expand their business. However, there is a very
limited study to recognize the most prominent barrier in the Malaysian food and beverages industry,
specifically in terms of Lean Manufacturing implementation. It is believed that, the implementation of
Lean Manufacturing will be easier if the prominent barrier is identified.

2.2.1. The barriers. As mentioned earlier, Khusaini has listed down the possible barriers to Lean
manufacturing implementation from year 2006 to year 2012. A total of twenty seven barriers have
been identified. The barriers are:

| LB1) Cultural change issues | LB15) Poor communication |
|----------------------------|-------------------------|
| LB2) Nature of manufacturing facility | LB16) Too many improvement programs at a time |
| LB3) Threats of downsizing among employee | LB17) Imitate lean practices |
| LB4) Issue with supplier | LB18) Lack of training |
| LB5) Unable to see lean benefits | LB19) Low skill workers |
| LB6) Hope to achieve quick result | LB20) Workers resistance to change |
3. Research Methodology

3.1 Instrument and Item Development.

The instrument was aimed to gauge the level of agreement towards every Lean Manufacturing barrier with respect to the Malaysian food and beverages industry. For this purpose, the survey consists of questions on organizations information such as year of establishment, total number of employees, ownership status and lean manufacturing implementation status. The questions on the Lean Manufacturing barriers consist of twenty seven barriers, in the form of 5-Likert rating. The questions were separated between two categories, namely Perception Barriers (LB1 to LB7) and Action Barriers (LB8 to LB27). It is worth mentioning that the Perception Barrier and Action Barrier had different rating number. For the Perception Barrier, the respondent were asked to rank their level of agreement from 5 – Strongly agree, 4 – Agree 3 – Somewhat agree, 2 – Disagree, 1 – Strongly disagree. As for the Action Barrier, the rating would be from 4 – Strongly agree, 3 – Agree, 2 – Some Somewhat agree, 1 – Disagree, 0 – Strongly disagree. All twenty-seven item (barriers) used came from the study conducted by Khusaini (16).

3.2 Participants.

Companies involved in this survey were identified from the FMM-MATRADE Industry Directory: Food and Beverage 4th Edition. A total of 1309 companies were discovered, consisting both large companies and SMEs. The companies were randomly chosen and a sample of 300 companies were obtained as suggested by Sekaran (17). Hence, a total of 300 questionnaires have been mailed out, together with a pre-paid envelope and cash voucher to encourage participation. Understanding the respondents’ busy schedule, they also may answer the survey questionnaires online. Out of 300 survey questionnaires sent, a total of 60 responses were received, but only 53 were used for further analysis. This gives a response rate of 17.7%. Rasch Model analysis were then performed to analyze the data using Winstep version 3.72.3.

3.3 Rasch Model.

Rasch Model is a probabilistic model, which is common to measure the latent traits, such as ability and stance. Initially, Rasch Model is used widely in educational-related study (18). Nevertheless, Rasch Model has now been applied in many more disciplines such as forestry, medical and health, optometry, occupational therapy and information technology. Rasch Model works in a way where, it measures the interaction between the person (respondent) and item at the same time, using the same scale simultaneously, which we refer as conjoint measurement (19).

In Rasch Model, a scale will be developed based on the response. The scale works just like a ruler – continuous and equal interval, with a measurement unit named as Logit. There are two fundamental theorem used in Rasch Model (20):
- A high ability person will most likely able to accomplish any given task;
- An easy task can be accomplished without difficulty by any person with any level of ability.
However, to relate it with this study, the fundamental theorems can be interpreted as:

- A successful Lean Manufacturing implementer will most likely be able to overcome any Lean Manufacturing barrier.
- A prominent Lean Manufacturing barrier will be experienced by any Lean Manufacturing implementer with any level of ability.

4. Results and Discussion

4.1. Variable Map

Rasch Model analyzes the latent trait concurrently – with the use of a map called Variable Map. The Variable Map consists of one vertical dashed line (which it functions just like a ruler), that separates the data generated for persons (on the left) and items (on the right). This vertical dashed line is represented by one established unit, called “Log of odd units” or “Logit” and has equal intervals. Logit is a unit of intangible measurement. Note that the letter M in the map represents the mean for item and person; whilst the letters S and T denotes one standard deviation and two standard deviations away from the mean, accordingly. The item mean has been calibrated (zero-set) by the Winstep software, and is always at zero (0) Logit. As for person, the mean for person depends on the respondents, since there is a 50:50 chance that these respondents agreed to the question asked.

Figure 1. The Variable Map

With respect to this study, on the left side, the organizations involved in the survey are ranked according to their ability towards Lean Manufacturing implementation. The organizations that have the highest ability are at the top, whilst the organizations that have the lowest ability are at the bottom. The same concept applies to the survey items on the right. The most agreeable Lean Manufacturing barrier is placed at the bottom, whilst the least agreeable Lean Manufacturing barrier is placed at the
top. From Figure 1, we can see that, the respondents agreed that all of the items in the Perception Barrier category (LB1-LB7) are indeed the common obstacles in the organizations. This proves that, the top management in each organization in this industry has to work to changing the mindset of everyone within the organizations. However, the most prominent barrier is the item LB6 (Hope to achieve quick results) which stands at -2.45 logit. This indicates that, the top management has delivered misleading mindset towards the people within the organizations, thus, expecting quick results. The change towards Lean Manufacturing is indeed a long term journey, and it should be consistent.

Also we can see that averagely at -0.67 logit, item LB8 (Lack of vision and direction) is the common problem faced by the organizations. The top management should convey a clear cut vision and direction, which is easy to understand, specific and achievable. Interestingly, the least agreeable Lean Manufacturing barriers are LB10 (Lack of top management knowledge), LB14 (No rewards and recognition), LB17 (Imitate lean practices) and LB25 (Low technology plant). These item stands at +0.55 logit. It shows that, the top management has acquired an acceptable level of Lean Manufacturing knowledge, and having a low technology plant is not an obstacle for them.

5. Conclusion
The outcome of this study is different from those conducted previously, since Rasch Model was used for analysis purposes. This study proves that, the problem with the organizations in the Malaysia food and beverages industry to implement Lean Manufacturing is basically on the mindset, hence the perception. For the organizations to move forward, a change in the mindset is crucial. A study should be conducted in terms of assessing the mindset at each different level within an organization so that the implementation of Lean Manufacturing would be much easier, and learnt by heart.

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