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MANAGEMENT OF SEVEN WASTES: A CASE STUDY IN AN AUTOMOTIVE VENDOR

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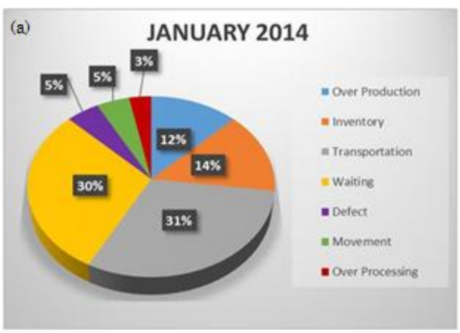
Graphical abstract



Abstract

Lean Manufacturing System (LMS) is an important approach that could maximize customer value and reduce the amount of waste. The use of LMS in Malaysia is still lacking especially among Small and Medium Enterprises (SME) in rural areas. The introduction of Islamic values to the existing LMS is expected to improve the awareness and acceptance of LMS especially among SME in rural areas. The merging of the Islamic values to the lean manufacturing tools is to leverage on the Islamic culture of the locals. The objective of this study is to assess the level of use and practice of lean manufacturing systems on management of seven wastes. This is a case study of an automotive vendor. A field observation was deployed and standard data was obtained for analysis. Field observation was performed by identifying critical areas with a high probability of waste production. The findings from this preliminary study suggest that three most critical causes of wastes are waiting, transportation, and movement. Results from this study is to be used in future to establish the equivalent Islamic LMS (ILMS) for targeted SMEs.

Keywords: Lean manufacturing, islamic concept, Malaysian industry.

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1.0 INTRODUCTION

Demands for a highly competitive and world class standard have forced many manufacturing firms to reduce wastes in the production to increase the efficiency. Adoption of Quality Management System (QMS) models such as Total Quality Management (TQM) and Lean Manufacturing System (LMS) in assisting the manufacturing firms meeting the demands is undoubtedly very important to remain competitive as reviewed in Salleh et al. [1]. In specific, LMS is a well accepted QMS model for waste reduction in manufacturing processes . Liker defines LMS as a human system which customer as the main focus [2]. LMS creates culture of continuous improvement of processes and production. One of the important elements of LMS is the seven wastes concept consisting of waiting time, transportation, movement, over production, inventory, defect and over processing. Table 1 shows the description of each of the seven wastes as by Hines and Taylor [3].

The use of LMS in Malaysia is still lacking especially amongst Small and Medium Enterprises (SMEs) in the rural areas. In accordance with the growth of manufacturing industries in Malaysia, the practice of LMS is very important to assist the firms achieving high production efficiency. The introduction of Islamic values to the conventional LMS is expected to improve the acceptance and readiness of the locals for LMS implementation especially in rural areas. Rokhman stated that the Islamic work ethics have positive effects on job satisfaction and organizational commitment [4]. With approximately 60 percent of muslim populations, Malaysia as one of the Muslim countries requires the merging of the Islamic values to the lean manufacturing tools to leverage on the Islamic culture of the locals.

Islamic teaching encourages moderation in many aspects of lives such as wealth, food and time. In the Al-Quran, there are a lot of verses prohibiting the act of wasting such as in Al-Isra': 26-27, "*But spend not wastefully (your wealth) in the manner of a spendthrift. Verily, the spendthrifts are brothers of the Shayatin (devils), and the Shaytan is ever ungrateful to his Lord*."

Allah said in other Ayat (Al-A'Raaf: 31), "*And eat and drink but waste not by extravagance*" [5].

The purpose of this study is to assess the level of LMS implementation on management of seven wastes for the purpose of establishing an equivalent ILMS future study.

Table 1 Description of LMS 7 wastes (adapted from Hines and Taylor [2])

	Type of Waste	**Description**
1	Overproduction	Producing too much or too soon, resulting in poor flow of information or goods and excess inventory.
2	Defects	Frequent errors in paperwork, product quality problems, or poor delivery performance.
3	Unnecessary inventory	Excessive storage and delay of information or products, resulting in excessive cost and poor customer service.
4	Inappropriate processing	Going about work processes using the wrong set of tools, procedures or systems, often when a simpler approach may be more effective
5	Excessive transportation	Excessive movement of people, information or goods resulting in wasted time, effort and cost
6	Waiting	Long periods of inactivity for people, information or goods, resulting in poor flow and long lead times.
7	Unnecessary motion	Poor workplace organisation, resulting in poor ergonomics, eg excessive bending or stretching and frequently lost items.

2.0 EXPERIMENTAL METHODS

2.1 Field Observation.

A case study of an automotive vendor was used as a preliminary study for assessing the level of LMS implementation. The data is used as a basis for the development of equivalent system of which to be called as an Islamic Lean Manufacturing System (ILMS). The selected vendor is a private limited company specializing in producing and assembling metal parts for the automotive industry. The paid up capital of the vendor reached MYR 5 million. This vendor had also participated in an earlier study conducted by Salleh et al. [6].

Field observation was performed by identifying critical areas with a high probability of waste production. The production planning and waste identification of the critical workstations were recorded with monthly basis from January until May 2014. The sample of recorded data is shown in Table 1.

Table 2 Sample of recorded data (Courtesy of the participating vendor)

Line	Assembly Line	Waste Identification		Date (Month)		3/5/2014 – 30/5/2014			Waste (Downtime) (%)							
Car Model	Proton			PIC Name		Zawawi (supervisor)										
Part Name	**Model**	**Plan**	**Actual**	**Different**	**Plan Hrs.**	**Actual Hrs.**	**D/T Hours**	**KPI(%)**	**O/Prod.**	**Inventory**	**Trans.**	**Waiting**	**Defect**	**Movement**	**O/Proc.**	**Total**
PNL QTR IRN LH	WRM 41 (Persona)	2740	2351	389	110.4	112.1	-1.7	85	1	2	4	4	2	1	1	15
PNL QTR IRN RH	WRM 41 (Persona)	2601	2315	286	104.8	118.3	-13.5	79	1	2	4	6	3	4	1	21
S/STRUCTURE LH	WRM 41/44	2856	2370	486	143.6	164	-20.4	73	2	3	6	7	3	3	3	27
S/STRUCTURE RH	WRM 41/44	2472	2352	120	124.3	131	-6.7	90	1	0	3	3	1	2	0	10
FR PLR ASSY LH	WRM 41/44	2596	2332	264	98.1	100	-1.9	88	1	1	2	4	2	1	1	12
FR PLR ASSY RH	WRM 41/44	2484	2364	120	93.8	98	-4.2	91	1	1	2	3	0	2	1	10
H/LAMP SUPT	WRM 41/44	3080	2774	306	230.1	225	5.1	92	1	0	2	3	1	1	0	8
Total		18829	16858	1971	905.1	948.4	-43.3	85								

KPI could be defined as:
KPI (%) = [(Actual/Actual Hours)] / (Plan/Plan Hours)] x 100%

Waste could be defined as:
Waste, W (%) = 100 – KPI (%)

3.0 RESULTS AND DISCUSSION

3.1 Prioritization of the LMS-seven-waste

Prior to assessing the level of usage and practice of LMS in the participating vendor, prioritization of the LMS-seven-waste in the assembly line was conducted using Pareto chart. Figure 1 shows the Pareto chart of the LMS-seven-waste observation in the assembly line of the participating vendor. Data shown in Figure 1 represents occurrence of downtime for five consecutive months starting from January to May 2014.

The Pareto chart highlights the critical causes of downtime in the process. It is shown in Figure 1 that the top three causes of critical downtime due to waiting time, transportation and unnecessary movement. The frequency of the downtime are 230, 199 and 116 respectively. Hence, these three downtime causes were selected and further discussed in the next section.

3.2 Distribution of the LMS-seven-waste

Figure 2 depicts the distribution of the LMS seven wastes for three consecutive months from January to March 2014. It is observed that within the three month period, the waiting time consistently falls among the three most frequent downtime causes. In January, waiting time contributed to 30% of the total downtime causes behind transportation (31%). In February, these two wastes; waiting time and transportation had also contributed to the largest amount of wastes with 27% and 21% respectively. The third largest cause of waste in February was unnecessary movement with 13% weightage. In March, the longest downtime was still caused by waiting time (28%) followed by transportation (23%) and unnecessary movement (17%).

Waiting time is closely related to excessive movement or transportation. The excessive movement of people causes them to be inactive. This has resulted to poor material flow and delayed of the production processes. Sheikh-Sajadieh et al found that many production waiting time occur due to the poor material flow, long production runs and excessive distance between work centers [7].

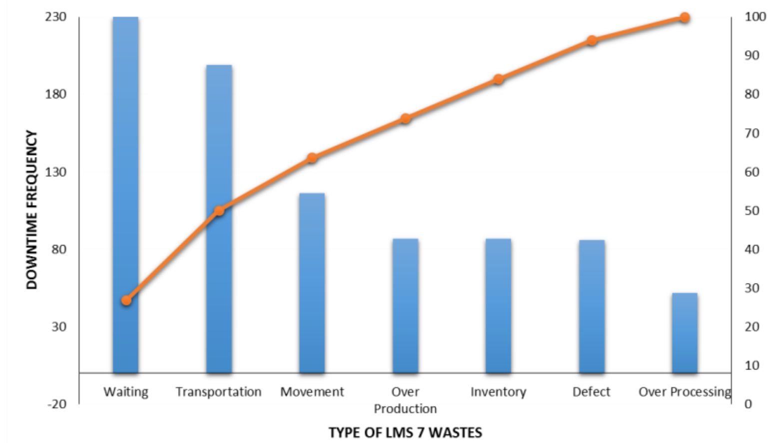

Figure 1 Pareto chart of LMS-seven-waste observation in the assembly line of the participating vendor

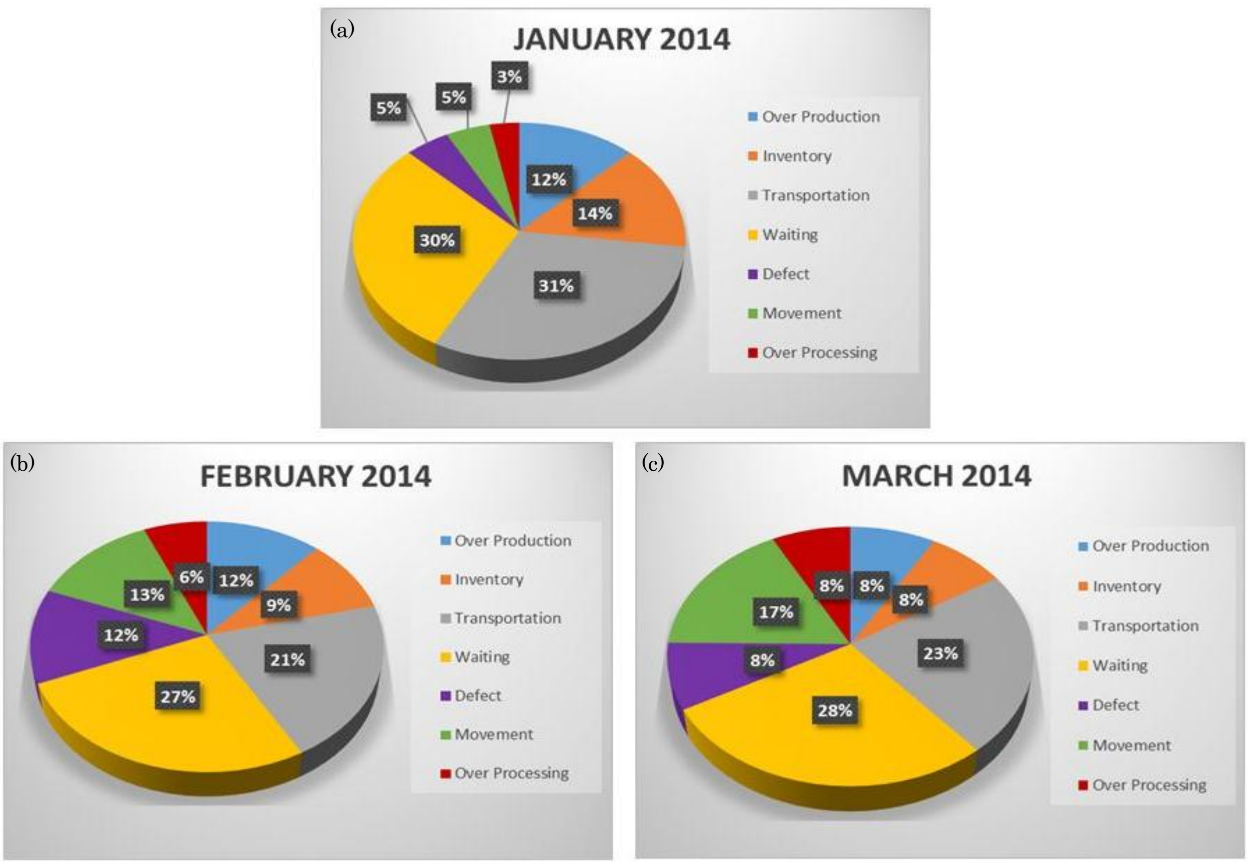

Figure 2(a), (b), (c) Distrubution of of the 7 wastes from January to March 2014 acquired by field observation

Based on Figure 2, the average percentage values of downtime frequencies for the three identified major causes; waiting time, transportation, and movement were 28%, 25%, and 12% respectively. This trend suggest for the need to look closer into these three aspects. Further investigation to overcome the problems are required. Nowadays a computer modelling software such as Delmia Quest as in Salleh et al. can help to virtually simulate and improve the existing layout without interfering the actual production line [8]. The simulation results also offer some basis into the development of an equivalent ILMS that currently understudies by the authors. A similar studydone by Jabir and Senik on TPS in the light of islamic values perspective was recently published and marked as one of the pioneer work in this respect [9].

4.0 CONCLUSION

This preliminary study was conducted to assess the level of LMS implementation on management of seven waste in a participating automotive vendor. Of seven LMS wastes, it was found that the three most critical causes of downtime in the assembly line were waiting, transportation, and movement. The average percentage values for downtime frequencies for the the three critical causes were 28%, 25%, and 12% respectively. The results indicate the need to look critically into the three major causes and to fully understand the interrelated consequences of these factors to fully understand their imperative impact on the assembly process. The results also offers some basis for development of equivalent ILMS to leverage on the local culture.

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