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THE INFLUENCE OF CONTEXTUAL FACTORS ON THE IMPLEMENTATION OF LEAN PRACTICES: AN ANALYSIS OF FURNITURE INDUSTRIES

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Abstract

Notwithstanding the research attention given to the implementation of lean practices, particularly in the developed countries, its adoption in the furniture industry in emerging economies is not promising and confined to a handful of studies only. The purpose of this study is to examine the influence of contextual factors related to company size and ownership on the implementation of lean practices. In doing so, a methodological approach was implemented after a thorough review of the literature on the topic. A comparative review on the definitions of contextual factors disclosed varying descriptions as expressed by different researchers. The analyses showed that contextual factors do not have any impact on the implementation of lean practices. The findings revealed that the contextual factors are unsuitable as mediators since there is no evidence of their effects on lean practice implementation. This study is the first attempt at examining the influence of contextual factors on the implementation of lean practices in Malaysian furniture industries. The theoretical and practical contributions of this study offer a valuable insight into the potential lean implementation in the context.

Keywords: lean implementation, contextual factors, firm size, firm age, corporate culture, furniture.

JEL Classification: L20, L25, L73, M14

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Introduction

Shortage of labour, poor knowledge on implementation, and the employees' opposition to change were found to be the main barriers in the implementation of lean manufacturing (LM) in the wood and furniture industry (Abu et al., 2019) specifically due to several reasons. Firstly, the number of labour resources determines the plant size (Abolhassani et al., 2016; Shah and Ward, 2003) and that the size of the SMEs is an enabler of lean implementation (Alkhoraif et al., 2019); hence, without which, the lean implementation is next to impossible. Secondly, the knowledge of employees (Redeker et al., 2019) affects the company's ability in employing the various lean manufacturing (LM) practices/tools (Shah and Ward, 2003). Hence, the company has to ensure that appropriate resources (in terms of the number of employees and expert employees) are made available before even attempting to implement such LM practices (Abolhassani et al., 2016). Thirdly, the employees' resistance to change will prompt negative organizational culture (Thanki and Thakkar, 2014). Pearce et al. (2018a) studied two first-time implementations of lean in SMEs and found that one of the companies failed in its first attempt because no one in the organisation truly understood how to gain the benefits of lean and that the existing operational culture which is in opposition to the lean principles was not changed. Therefore, both hard (e.g. plant size and resource availability) and soft (e.g. organizational culture) facets of the organizational structure may act as determinants in an organization's ability to implement and sustain lean performance (Bortolotti et al., 2015; Pearce et al., 2018b). However, organizations must ensure their capacity in accepting the lean methods prior to applying any lean practices/applications to succeed in the long-term (Gholami et al., 2019; Jamil et al., 2020).

Although the benefits of lean manufacturing have been anecdotally and empirically proven in numerous studies as thoroughly enumerated by Abu et al. (2019), very few theoretical and methodological studies on the matter had been conducted on wood and furniture companies specifically in the developing countries as evidenced by the lack of literature in this context. This is also true in the context of the Malaysian wood and furniture industry as discovered by the current authors. Therefore, this paper is undertaken to clarify the following question, which was fundamentally formulated to further the research purpose: *What is the influence of the contextual factors related to company size and ownership on the implementation of lean practices in Malaysian wood and furniture industries?*

Hence, this current study intends to fill the existing gap and contribute to the body of knowledge by addressing the aforementioned question. The main contributions of this paper are, firstly, the comparative review offers an understanding of the contextual factors through the scenarios performed in developing countries. Secondly, the paper provides empirical evidence about the mediating role of the factors in lean practices implementation from the perspective of the Malaysian wood and furniture industry.

1. Literature review

To achieve the research purposes, this section discusses the specific domains based on the review of contemporary and conventional studies on the possible influencing factors of LM implementation in light of the institutional theory. Marodin et al. (2016) suggested that the contextual factors can be tested as mediators if there is empirical evidence of their effects

on LM practices. A summary of this review is presented in table no. 1, where the main studies in the under-researched scope are characterized against the factors.

Table no. 1. The summary of literature review on the factors influencing the implementation of LM practices

Study	Brief summary	Factors		
		Age	Size	Ownership
Tehseen et al., 2018	Study on the impact of network competence on four types of firms' performances relative to competitors-among Malaysian SMEs run by Chinese and Indian entrepreneurs.			X
Surin et al., 2017	Investigate the relationship between strategic business network and business performance among SME manufacturing firms in Malaysia.			X
Abolhassani et al., 2016	Study on obstacle and lean strategic practices in implementing lean manufacturing by Pennsylvania and West Virginia manufacturers <i>H1- The level of implementation is correlated with benefit for lean strategic practices; H2- The frequency of use of lean strategic practices increases with facility size (number of full-time employees); H3- The frequency of use of lean strategic practices increases with years of practicing lean</i>		X	
Kheng and Minai, 2016;	Investigates the network characteristics among Chinese owner-managers and their relationship with SMEs' performance.			X
Marodin et al., 2016	Study on the relationship between lean implementation with the firms size, position within the supply chain and time length of the lean initiatives. <i>H1- Firm with higher degree of LP implementation are more likely to have better operational performance than those with a lower degree of implementation; H2- The degree of LP implementation is positively associated with the size of the firm; H3- Firm that have from two to five years of a formal LP initiative are more likely to have a higher degree of LP than those that have a formal LP initiative for less than two years; H4- Firm that have more than five years of a formal LP initiative are more likely to have a higher degree of LP than those that have a formal LP initiative from two to five years</i>		X	
Panwar et al., 2015;	Study on the practice, reason and challenge of lean implementation in Indian process industries.		X	
Vilkas et al., 2015	Surveying of Lithuanian companies that practicing lean production to identifies the popular lean practice used, motive of practicing lean and the effects to the operational and business performance.	X		
Hassan et al., 2013	Investigates on what and how Bumiputera SMEs manufacturing entrepreneurs are able to sustain in wood-based products in Malaysia.			X
Pirraglia et al., 2009	Study on the lean practices between secondary wood manufacturer from the Wood Component Manufacturing Association (WCMA) in the United States (U.S.) and the advantages of lean implementation.		X	
Shah and Ward, 2003	Study on the effect of contextual factors and practice bundle on the operational performance. <i>H1- Organizational context has no impact on implementation status of a lean practice; P1- Large manufacturers are more likely to implement lean practices than small manufacturers; P2- Older plants are less likely to implement lean manufacturing practices than newer plants</i>	X	X	

Note: X=statistically significant in the analysis or discussed by the authors as being important.

Firm age. Plant *age* is negatively associated with lean implementation and is less pervasive than conventional wisdom suggests (Shah and Ward, 2003). It was suggested that new plants which are less than 10 years old are more likely to implement LM practices (Vilkas et al., 2015). Due to less pervasive findings based on the plant's age, researchers examined the inhibitors to LM implementation based on years of practicing lean (Browning and Heath, 2009). Therefore, it is important to determine the contextual factors based on company size for this study because the influence of the plant's age is less noticeable compared to the plant's size (Shah and Ward, 2003).

Firm size. Plant *size* and plant description are examples of several possible contextual variables (Rezaei et al., 2016; Arana-Solares et al., 2019). There is evidence that strongly support the effect of the plant's size on lean implementation (Shah and Ward, 2003). Based on the ANOVA analysis, there is a statistical difference in the mean score of the lean implementation levels for numerous facility sizes (Abolhassani et al., 2016). The wood and furniture industry is considered a small size industry (Cottyn et al., 2011; Miller et al., 2010) or medium to small sized industry (Meiling et al., 2011; Longoni and Cagliano, 2015). The findings by Abolhassani et al. (2016) and Marodin et al. (2016) suggested that bigger companies implement more lean tools than the smaller ones. Moreover, Khanchanapong et al. (2014) argued that lean practices are more suitable for large sized manufacturers with high volume production systems. For example, there are convincing arguments that the plant size significantly impacts all lean practices (study on 22 LM practices) except for two practices i.e. cross-functional work force and QM programs (Shah and Ward, 2003). On top of that, Marodin et al. (2016) in their cluster analysis found that 30 small-sized firms were associated with low lean adopters while the high lean adopters were composed of 34 medium-sized firms. The three main outcomes from the research are: firstly, 4 out of the 11 LM practices (visual management, problem-solving, one-piece-flow and pull production) are statistically different between large firms and small/medium-sized firms; secondly, medium-sized firms have higher LM implementation than small-sized firms for the practice of problem-solving; and thirdly, medium-sized firms face less challenges than small-sized firms when practicing visual management, standardized work and problem solving. Although many researchers have attempted to identify the influence of company size on the frequency of LM practices, the implementation of LM practices are widely varied based on the companies' background. Furniture companies within the UK-based facilities transformation journey started with significant changes in the workplace such as operator training, standard work, improved safety practices, and 5-S clean-up of plants (Piercy and Rich, 2015). Yet, large furniture companies in the US consider employee training as the starting point for LM and seem to be using internal staff learning through training programs as a method to initiate/implement LM, while the smaller companies seem to be in process improvement (Pirraglia et al., 2009). Thus, further research to explore the current circumstances for the Malaysian wood and furniture industry is suggested (National-SME-Development-Council, 2013; Amin et al., 2016).

Corporate culture. With regards to *ownership*, organizational culture is not fully visible, but an observer can directly recognize the behaviour or cultural symbols in an organization (Urban, 2015; Rezaei et al., 2017). Uniquely, Malaysia is a multicultural country in which Malays, Chinese, and Indians dominate a majority of businesses (Tehseen et al., 2018; Jiran et al., 2019). Most of the SMEs are managed by Chinese (Kheng and Minai, 2014) and only a few wood-based companies are owned by Malays or the Bumiputera (Sharma and Shah, 2016). Thus, the Malaysian government has bestowed grants for the Bumiputera companies

to sustain their business in the wood and furniture industry (MTIB, 2018). The government supports such incentives and benefits to facilitate lean (Hussain et al., 2019) is not a prominent issue in Malaysia. As far as the Malaysian wood and furniture industry is concerned, the government of Malaysia under the MTIB has taken initiatives to increase the productivity and promote the quality of the factory environment through Lean Manufacturing and Good Manufacturing Practices (GMP) – 5S (MTIB, 2017). This is because multinational companies (82%) are more prominent in implementing LM practices in their production area whilst only half of the domestic companies (9%) had implemented LM (Mund et al., 2015). Moreover, the Malaysian government has provided many initiatives to strengthen the development of Small and Medium Enterprises (SMEs) (Abdul-Halim et al., 2018). Similarly, the government of India had established a Lean Manufacturing Competitive Scheme (Thanki and Thakkar, 2014; Shashi et al., 2019) which provides various incentives including training employees and hiring consultants to increase technical knowledge during LM implementation (Ramakrishnan et al., 2018). However, different nations have different labour intensities, developments, cultures, industrialization positions as well as education and training (Alkhoraif et al., 2019). Still, not much is known about LM implementation in relation to company ownership. There is a remarkable lack of comparative studies with regards to the different company ownerships in the Malaysian wood and furniture industry, a gap that calls for immediate study.

2. Methods

This study leans more to be an applied research by reaching out to wood and furniture manufacturing companies directly. The framework begins with the main research questions developed from the project background on one hand, and the cutting-edge literature review comprising an assessment of several related keywords on the other. To answer the research question, a methodological approach was employed using a survey deployed in confirmatory phase (large scale study) to examine the relationship between the two contextual factors.

2.1 Sample administration

The steps involved in administrating the sample selection begins by identifying the potential respondents. Firstly, we purposefully sampled Bumiputera companies from the Association of Bumiputera Timber and Furniture Entrepreneur Malaysia (PEKA) and Chinese companies from the Kuala Lumpur Selangor Furniture Association (KLSFIA). Secondly, a list of wood and furniture companies that have joined the GMP and lean management program were gathered from the Malaysian Timber Industry Board. Thus, the homogeneous sampling strategy was used because the samples share the same trait i.e. being lean companies (companies that have implemented lean practice). Thirdly, in order to increase the response rate, the snowball sampling was used. Participants from the MTIB exhibition (Wood and Lifestyle fair in six different states) were asked to recommend other companies (which have not participated in the fair) to be sampled (through online survey).

To accomplish the research goal, the organization was used as the unit of analysis; therefore, all furniture companies of all sizes and age registered under the MTIB and furniture association in Malaysia were allowed to participate. Non-lean companies were

included as the target sample. Non-lean respondents were required to provide the reasons for not implementing lean. The survey approach entails giving out questionnaires that can be efficiently completed by the companies including those without any lean knowledge.

Subsequently, the list of samples was refined to eliminate redundancy. In all, three reasons for eliminating the samples were resolved. Firstly, the same companies had upgraded their manufacturing system from GMP to lean in the following years. Secondly, there were duplicate company samples from MTIB, MFPC and MFC's databases. Thirdly, the duplicate companies were arranged based on categories such as home furniture, office furniture, kitchen furniture, mattress & bedding, home appliances & AV, kitchen appliances, soft furnishings, flooring & ceramic, landscaping, door & window, bathroom accessories, security & safety, home services and decorative items.

Finally, the complete list of samples is all set for the survey study. From the total of 1237 companies in the directory, 599 companies were selected. The other 638 company contact information listed was unavailable due to private and confidential reasons. Out of the total listing, only 104 wood and furniture companies were guaranteed to have adopted lean practice. The shortlisting of the judgmental sampling was based on prior discussions and advices from lean consultants appointed by MTIB and the personnel in charge of each organization/ association.

2.2 Statistical analysis

The statistical analysis (Levene's test of equality of error variances and one-way ANOVA) was carried out using the Statistical Package for Social Sciences 25.0 (SPSS) i.e. a standard research analysis software. Using the method by Abolhassani et al. (2016), the arrangement for the data analysis was followed with the three key stages namely: (1) carrying out a descriptive analysis of the results to show the general characteristics of each LM practice, (2) testing the variance homogeneity assumption where a null hypothesis indicates no difference between the number of means of the group's variances (Oak, 2019), and (3) conducting a one-way ANOVA (single factor analysis of variance) to determine if there is a significant difference in the mean scores of the dependent variable (for two or more groups).

3. Results and discussion

The findings were grouped into two according to the research methodology. Firstly, the results of the analytic approach from the survey deployed in confirmatory phase. Secondly, the facility size and ownership descent used to segregate the relationship between the two contextual factors.

3.1 Results of the analytic approach

A face-to-face and e-mail survey was used to collect data from a total of 599 registered wood and furniture companies in Malaysia. A total of 201 responses were received, which corresponds to an overall response rate of 34%. However, 24 responses collected from the MF3 were rejected because they do not belong to the wood and furniture industry, considering that their main products are water filters, air purifiers, carpets, fire prevention

items, household cleaning items, security items, insect screenings, and kitchen appliances. The classifications of the companies that have responded to the survey are: furniture and parts (52%), cabinet products (24%), carpentry/flooring (19%), bio-composite products (5%) and others (28%). Other products specified by the respondents are mattress and bedding, home and kitchen appliances, garden furniture, wallpaper, crafts and others.

Therefore, 177 valid responses were used for further analysis, with 46 and 131 respondents belonging to lean and non-lean companies respectively. A majority of the responses were collected through face-to-face survey (93%). Results from the pilot-study presented similar trends in which the companies were not willing to respond through e-mail even though a phone number and WhatsApp contact were provided to increase the response rate. An additional web link provided to encourage more online responses was poorly utilized.

On average, the mean companies' age for the 177 companies with valid responses was 13.24 years old (std. dev. 9.95). The oldest company was 60 while the newly developed company is one-year-old. The general company information revealed that a majority of the respondents were in the top management i.e. director, manager (41%), Bumiputera companies (58%), producing furniture and parts (52%), small companies with a number of employees between 5 and 75 (62%), and companies that have been operating for 10 years (15%). The other respondents were made up of designers, product specialists, consultants, salespersons and etc. Only six companies were owned by foreigners i.e. from Belgium, Korea and Pakistan.

3.2 Findings and discussion on the contextual factors

The effects of lean practices on the organizational context are presented. First, the Levene's test of equality of error variances was performed before executing one-way ANOVA. Next, the findings were examined whether the degree of LM implementation has any impact on company size and ownership.

- *Company size (number of employees)*

The Levene's test showed no significant dependent variables except for Kanban. It was assumed that there is an equal error variance for the dependent variables (all 15 LM practices) for all the groups thus allowing for the ANOVA test to be conducted. For the Kanban variable, the F value for the Levene's test is 4.284 with a Sig. (p) value of 0.015. As the Sig. value is less than our alpha of 0.05 ($p < 0.05$), the null hypothesis (no difference) was rejected for the assumption of variance homogeneity thus leading to the conclusion that there is a significant difference between the group of variances. Due to violation of the assumptions of the one-way analysis of variance, additional Welch and Brown and Forsythe tests were performed. However, the robust tests of equality of means cannot be performed for Kanban because at least one group has zero variance. Further searches found that all five respondents from the micro-sized companies answered on the similar measurement scale (4 = often used). Marodin et al. (2016) excluded one LM practice due to a significantly low number of observations i.e. five. Hence, Kanban was omitted from subsequent one-way ANOVA analysis.

Table no. 2 presents the one-way ANOVA for the LM practices according to the company sizes. The mean differences for all levels of the independent variables (company sizes; micro, small, medium and large) were tested for all LM practices (dependent variables). The dependent variable sums the frequency of lean tool usage (seldom, sometimes, often

and always used) with the assumption that all the LM practices are of similar weight (Abolhassani et al., 2016). All 46 observations from the lean tool questionnaire were used to calculate this index. No significant difference was found in the frequency of lean practice implementation based on company size.

Table no. 2. One-way ANOVA for the LM practices by facility size

LM practices	Levene's test Sig. (p) value	Means			ANOVA Table					
		Small	Medium	Large	Source	df	SS	MS	F	p
5S	0.463	3.71	4.40	4.50	Factor	3	3.71	1.24	1.73	0.18
					Error	39	27.91	0.72		
					Total	42	31.63			
Process mapping	0.907	3.79	3.83	3.50	Factor	3	1.22	0.41	0.33	0.81
					Error	31	38.33	1.24		
					Total	34	39.54			
Waste identification and elimination	0.270	3.94	3.67	3.75	Factor	3	0.55	0.18	0.24	0.87
					Error	29	22.36	0.77		
					Total	32	22.91			
Visual management	0.250	3.89	3.67	4.33	Factor	3	1.65	0.55	0.47	0.71
					Error	30	35.29	1.18		
					Total	33	36.94			
Kaizen/ Continuous improvement	0.420	3.89	3.80	4.33	Factor	3	1.76	0.59	0.75	0.53
					Error	26	20.24	0.78		
					Total	29	22.00			
Pull systems/ JIT	0.139	3.89	3.40	3.00	Factor	3	2.96	0.99	1.07	0.38
					Error	27	24.98	0.93		
					Total	30	27.94			
Work standardization	0.827	3.94	3.33	3.67	Factor	3	2.44	0.82	2.33	0.10
					Error	28	9.78	0.35		
					Total	31	12.22			
VSM	0.071	3.47	3.60	3.00	Factor	3	0.60	0.20	0.17	0.92
					Error	26	30.77	1.18		
					Total	29	31.37			
One piece flow	0.176	3.71	3.25	3.50	Factor	3	0.72	0.24	0.20	0.90
					Error	25	30.11	1.21		
					Total	28	30.83			
TPM	0.613	3.88	3.50	4.00	Factor	3	0.89	0.30	0.27	0.85
					Error	28	30.58	1.09		
					Total	31	31.47			
OEE	0.643	3.50	3.33	4.33	Factor	3	2.01	0.67	0.71	0.56
					Error	24	22.67	0.94		
					Total	27	24.68			
Error proofing/Poka yoke	0.298	3.53	2.33	4.00	Factor	3	4.44	1.48	1.47	0.25
					Error	24	24.24	1.01		
					Total	27	28.68			
Takt time	0.646	3.67	3.50	3.50	Factor	3	0.10	0.03	0.04	0.99
					Error	23	20.20	0.88		
					Total	26	20.30			
Employee training	0.714	4.11	4.00	3.67	Factor	3	1.92	0.64	1.17	0.34
					Error	29	15.96	0.55		
					Total	32	17.88			
Quality control	0.746	4.55	4.33	4.00	Factor	3	3.93	1.31	2.37	0.09
					Error	32	17.71	0.55		
					Total	35	21.64			

Note: $p < 0.05$; Sum of Squares (SS); Mean Square (MS); Kanban was deleted because at least one group has 0 variance.

- *Ownership*

Table no. 3 presents the one-way ANOVA for the mean of the LM practices by company ownership. No significant dependent variables were shown by the Levene's test (all 16 LM practices). The sig. (p) value for all the LM practice variables is greater than the alpha value ($p > 0.05$). It was assumed that the error variance of the dependent variable is equal across all groups. Thus, the assumption of homogeneity of variance is met and the ANOVA test can proceed. As already mentioned, the dependent variable sums up the level of each LM practice implementation (seldom, sometimes, often and always used) based on the assumption that all of them have similar weights. No statistical difference was found in the frequency of lean tool implementation based on company ownership i.e. a significance level of 5%.

The main reason could be because the local Malaysian-owned companies are in the starting phase of LM implementation. The lean journey has just started for most of the companies through the initiatives taken by MTIB from the lean and GMP 5S programs. Moreover, the awareness among wood and furniture companies is still low. Thus, there is not much difference in the frequency of lean tools implementation based on company ownership.

Table no. 3. One-way ANOVA for the LM practices by ownership

LM practices	Levene's test Sig. (p) value	Means			ANOVA Table					
		Bumiputera	Chinese	Others	Source	df	SS	MS	F	p
5S	0.325	3.74	4.33	4.33	Factor	2	3.026	1.513	2.116	0.134
					Error	40	28.602	0.715		
					Total	42	31.628			
Process mapping	0.789	3.75	3.50	3.67	Factor	2	0.376	0.188	0.154	0.858
					Error	32	39.167	1.224		
					Total	34	39.543			
Waste identification and elimination	0.063	3.86	3.63	4.00	Factor	2	0.443	0.222	0.296	0.746
					Error	30	22.466	0.749		
					Total	32	22.909			
Visual management	0.302	3.75	3.86	4.33	Factor	2	0.917	0.459	0.395	0.677
					Error	31	36.024	1.162		
					Total	33	36.941			
Kaizen/ Continuous improvement	0.531	3.90	4.17	4.33	Factor	2	0.690	0.345	0.437	0.650
					Error	27	21.310	0.789		
					Total	29	22.000			
Pull systems/ JIT	0.913	3.91	3.50	3.00	Factor	2	2.617	1.309	1.447	0.252
					Error	28	25.318	0.904		
					Total	30	27.935			
Work standardization	0.207	4.00	3.43	3.67	Factor	2	1.838	0.919	2.567	0.094
					Error	29	10.381	0.358		
					Total	31	12.219			
VSM	0.053	3.55	3.17	3.00	Factor	2	1.079	0.539	0.481	0.623
					Error	27	30.288	1.122		
					Total	29	31.367			
One piece flow	0.143	3.77	3.00	3.50	Factor	2	2.464	1.232	1.129	0.339
					Error	26	28.364	1.091		
					Total	28	30.828			
TPM	0.838	3.76	3.75	4.00	Factor	2	0.159	0.080	0.074	0.929
					Error	29	31.310	1.080		
					Total	31	31.469			

LM practices	Levene's test Sig. (p) value	Means			ANOVA Table					
		Bumiputera	Chinese	Others	Source	df	SS	MS	F	p
OEE	0.765	3.57	3.25	4.33	Factor	2	2.119	1.060	1.174	0.326
					Error	25	22.560	0.902		
					Total	27	24.679			
Error proofing/Poka yoke	0.931	3.33	3.40	4.00	Factor	2	0.812	0.406	0.364	0.698
					Error	25	27.867	1.115		
					Total	27	28.679			
Takt time	0.474	3.57	4.00	3.50	Factor	2	0.653	0.327	0.399	0.675
					Error	24	19.643	0.818		
					Total	26	20.296			
Employee training	0.736	3.83	4.43	3.67	Factor	2	2.193	1.097	2.098	0.140
					Error	30	15.685	0.523		
					Total	32	17.879			
Quality control	0.984	4.27	4.57	4.00	Factor	2	0.809	0.405	0.641	0.533
					Error	33	20.830	0.631		
					Total	35	21.639			
Kanban	0.214	3.89	4.17	3.67	Factor	2	0.574	0.287	0.519	0.602
					Error	24	13.278	0.553		
					Total	26	13.852			

Note: $p < 0.05$; Sum of Squares (SS); Mean Square (MS).

3.3 Integrative discussion

This section presents the summary of the research study in relation to the relationship between the two contextual factors. First, each lean implementation issue and its contextual factors are highlighted from the previous study. Then, a discussion of the research approaches for large scale survey was carried out. Finally, a report is generated on the analysis of LM practice adoption by company size and ownership based on the research questions.

Firstly, this study presents a complete literature review on the organizational context characteristics that may influence the implementation of LM practices. There has been no detailed investigation of the contextual factors and LM implementation in the Malaysian wood and furniture industry. Conventional literature suggests that the influence of LM practices by plant age are less noticeable while contemporary literature suggests on plant size and years of practicing lean which is delivered in more pervasive findings. Due to the notable paucity of information on lean tools adopted by the wood and furniture industry in Malaysia, the selection of LM practices was made based on the research of Pirraglia et al. (2009) which were then validated by two MTIB-appointed lean consultants for the lean and GMP-5S program.

The findings from the comprehensive reviews show that there are different contextual variable definitions. For example, small companies were defined as those with 5 to 75 employees (Chin and Lim, 2018; Ali et al., 2019), 5 to 50 (Amin et al., 2016), less than 50 (Abolhassani et al., 2016), below 80 (Pirraglia et al., 2009), below 100 (Marodin et al., 2016) and below 250 (Shah and Ward, 2003). If we consider the contextual variable defined by Shah and Ward (2003), then even large companies are grouped under the category of small companies based on the Malaysian context. It is interesting to identify

whether the outcomes will be similar when the contextual variables are different based on Malaysian organizational characteristics.

Secondly, a total of 599 companies were selected from the total estimated number of 1237 companies in various directories. The shortlisting of judgmental sampling was based on prior discussions and advices from lean consultants and personnel-in-charge in the wood and furniture associations. The respondents were assessed through e-mail, phone contact, WhatsApp and third-party channels. The questionnaire was used to evaluate the demographics of the respondents, identify the knowledge and practice of lean tools, and measure the expertise and interpretation of LM practices. The sixteen LM practices identified are 5S, process mapping, waste identification and elimination, visual management, kaizen/ continuous improvement, pull systems/JIT, work standardization, VSM, one-piece flow, TPM, OEE, error proofing/poka yoke, takt time, employee training, quality control and Kanban.

Thirdly, out of the 599 registered wood and furniture companies in Malaysia, a total of 201 responses were received. The overall response rate is 34%. Subsequently, 24 responses were rejected which resulted in 177 valid responses. Resultantly, it was found that 46 respondents had implemented lean while 131 were non-lean companies.

Fourth, the one-way ANOVA for the LM practices showed that there is no relationship between LM practices with plant size and company ownership. The finding shows that there is a reverse outcome for the two contextual factors with previous research study. The contextual factors cannot be tested as the mediators of the relationship between LM practices as proposed by Marodin et al. (2016) because there is no empirical proof of the contextual factors' effect on the LM practices.

Conclusions and future research directions

A survey-based research was conducted with data collected from 177 Malaysian wood and furniture companies to answer, *what is the relationship between the use of lean practices with company size and ownership?* The data was analysed by frequency (%) and one-way ANOVA or single factor analysis of variance. The independent variables tested are company size (micro, small, medium and large) and ownership (Bumiputera, Chinese, Indian and others). Levene's Test of Homogeneity was used to test the assumption for the one-way ANOVA. The dependent variable used to differentiate the individuals based on quantitative (continuous) dimensions are the degree of lean tools implementation (not used, seldom used, sometimes, often used and always used).

A comparative review of the definitions of the contextual variables revealed that they were expressed in various ways by researchers. It is worth noting that based on the Malaysian context, company size was defined differently. The questionnaire structure was adapted from Panwar et al. (2015) while the LM practices were amended from Pirraglia et al. (2009). A large scale study was conducted for 599 registered wood and furniture companies in Malaysia which resulted in 177 valid responses.

Surprisingly, the degree of lean tools and LM practice implementation was statistically similar among the various groups of company sizes and ownerships. In sum, the organizational context does not affect the status of lean practice implementation. Thus, it can be concluded that there is no relationship between company size and ownership in the Malaysian organization context.

This research is subject to the limitations that suggest directions to further research. (i) The results were bounded by the characteristics of the sample (i.e. wood and furniture industry in Malaysia). The lean concept is new for the practitioners. Thus, expanding the research study in the next three to five years will be beneficial for future studies. The same companies could be compared in terms of LM practices maturity and contextual influence. (ii) The information of the company age was collected to understand the group of companies participating in this study. However, their responses were not analysed for two reasons: firstly, lean is a new paradigm for the Malaysian wood and furniture industry. Secondly, there are contradictions in the literature about plant age and lean implementation. Shah and Ward (2003) concluded that plant age is negatively associated with implementation, while Vilkas et al. (2015) found new plants which are less than 10 years old were more motivated to adopt lean tools. Based on the comparative review section, most of the lean companies have yet to achieve the spell time. (iii) Lean and operational performance also need to be examined in terms of the benefits and companies' reasons for not adopting LM practices.

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