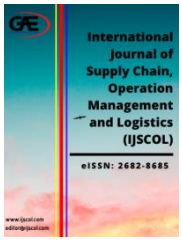

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LEAN MANUFACTURING ADOPTION IN MALAYSIA: A SYSTEMATIC LITERATURE REVIEW

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Abstract:

The purpose of this paper is to perform a systematic literature review (SLR) on lean manufacturing (LM) adoption in Malaysia while highlighting research trends and gaps from this literature. The SLR involved analysing 163 scholarly articles from international journals and conference proceedings published between the year 2005 to 2019. The articles are classified as literature review, conceptual paper, case study, and survey research. These articles were also grouped into nine meaningful research themes, named: (1) lean definitions, (2) sustaining lean adoption, (3) motivations to adopt lean, (4) lean benefits, (5) results from lean adoption, (6) lean implementation barriers, (7) lean success factors, (8) lean implementation/ assessment models, and (9) lean integration with other management practices. The review findings shall help scholars and practitioners to identify research opportunities, design their future studies and/or implementation strategies, accordingly.

Keywords:

Lean Manufacturing, Lean Production, Malaysia, Systematic Review, Research Trends

Introduction

Lean manufacturing (LM) is simply referring to manufacturing methodologies based on maximizing value and minimizing waste in the manufacturing process (Abdul Rashid, Shaari, Mohamad Zakuan, & Hasan Basri, 2010). It is inspired from Toyota Production System (TPS) founded by a Japanese industrial engineer named Taiichi Ohno post World War II. The adoption of Lean manufacturing (LM) have been discussed globally for decades. One of the pioneer literature in this subject of interest is "Triumph of the Lean Production" by John F Krafcik (Krafcik, 1988). Krafcik is said to be the first author who coined and used the term

"lean production" to address TPS in the scholarly articles. The "lean production" term was further popularized by Womack, Jones, and Roos (1990) in their best-selling book entitled "Machine that Change the World" (Bicheno & Holweg, 2009; Lean Enterprise Institute, 2014). Due to its frequent adoption in the manufacturing environment, its name evolved to "lean manufacturing" (Becker, 1998).

Since the publication of Machine that Change the World until year 2013, there are 4,130 publications on lean under several search key terms such as lean production, lean manufacturing, lean process, lean management, lean thinking, etc. (Samuel, Found, & Williams, 2015). These enormous number of literatures on lean adoption points to the need to organize and manage the available knowledge. This includes analysing the research trends and identifying opportunities for future research. The SLR by Psomas and Antony (2019) serves as one of the examples of LM systematic review, but it was focussing on LM research trends globally. Psomas and Antony (2019) reported, based on 120 articles, majority are survey researches, while the minority are conceptual papers. Moreover, they concluded that the primary focus of LM adoption studies was regarding "lean effects", and that "lean benefits" studies were scarce.

The present SLR is different from other published literature review articles on LM so far, by focussing on LM research trends and future research opportunities specifically in Malaysia context. Given very few LM studies from Malaysia were included in global-scope LM review articles, despite almost 200 articles can be accessed from Google scholar search engine. For instance, only one article was included in Jasti and Kodali (2015) review, two articles in Psomas and Antony (2019), and the most were in Bhamu and Singh Sangwan (2014) with the total of six articles. In fact, based on 194 articles downloaded from Google scholar search engine under "lean manufacturing Malaysia" and "lean production Malaysia" key terms, none of these articles is about systematic review on LM adoption in Malaysia context. Thus, these issues support the need of the present SLR on this topic of interest. Therefore, the following research questions are put forward: (1) What are the main themes in LM research trends in regard to Malaysia context? and (2) What are the opportunities for future research on LM to be conducted in Malaysia?

Literature Review

This section covers the history and development of lean manufacturing in Malaysia as well as the background of systematic literature review protocol.

Lean Manufacturing Scenario in Malaysia

Lean at the highest level can be viewed as a philosophy (Arlbjørn & Freytag, 2013), whereby lean philosophy refers to the definition of lean, its principles and main concepts (Gupta & Jain, 2013). Hence, its application is universal and deemed suitable in any business (Tracey & Flinchbaugh, 2009; Veech, 2004). This implies that the adoption of lean philosophy (i.e. principles and main concepts) can improve any kind of work and anywhere in the enterprise (Koenigsaecker, 2012). This is the reason why nomenclatures such as lean services, lean construction, lean healthcare, and lean education emerged in the literature. The act of adopting lean philosophy into any kind of business settings to replace the old mindset and work process for the sake of improvement is termed as "Lean Transformation" (Koenigsaecker, 2012; Roth, 2011).

The first formal Lean Transformation in Malaysia manufacturing sector was reported in year 2006. This transformation involved local automotive industries through the initiation of

Malaysia Japan Automotive Industries Cooperation (MAJAICO) program to develop and mould local automotive industry into competitive industry players globally (Abdul Wahab, Mukhtar, & Sulaiman, 2017; Muslimen, Mohd Yusof, & Zainal Abidin, 2011). However, the earliest published scholarly article on LM studies in an anonymous Malaysia manufacturing setting was found in year 2005 (Mohamed Ariff & Ahmed, 2005). This is followed by a study in an aerospace composite manufacturer (Puvanasvaran et al., 2008), before reaching to automotive (Mohamad Zakuan & Mat Saman, 2009) itself, and electrical and electronics (E&E) industries (Wong, Wong, & Ali, 2009).

Pioneer survey researches in Malaysia manufacturing settings had reported the level of LM adoption by local manufacturers was moderate (Nordin, Md Deros, & Abd Wahab, 2010b; Puvanasvaran et al., 2008; Wong et al., 2009). Nevertheless, Malaysian manufacturers continue to show high tendency of implementing LMS to pursue improvement in terms of product quality and durability according to a more recent survey (Yusup, Wan Mahmood, Salleh, & Mohd Yusof, 2014). As per the growing interest, federal government through Malaysia Productivity Corporation (MPC) also have set interest and demonstrated commitment on Lean Management since 2011. MPC's lean journey was initiated as part of improving the operations of the small and medium enterprises (SMEs) in Malaysia. The journey started off with a Module Capacity Building for MPC's officers in collaboration with experts from various industries. This was done to ensure that MPC officers would be well trained before assisting the local SMEs and other government institutions.

In 2014, MPC organised the first Creanova LEAN that attracted a total of 89 organisations from both public and private sector to attend this LEAN Management information and best practices sharing event (Malaysia Productivity Corporation, 2014a). Creanova LEAN is a platform of sharing learning experiences resulting from the implementation of LEAN and Kaizen projects. The word Creanova is derived from the merging of two words, 'Creativity' and 'Innovation'. Additionally, the program aims to strengthen the network of strategic and collaborative collaborations among LEAN practitioners, experts, industry and scientists in order to continue the practice and culture of LEAN. Creanova LEAN is also a stage where successfully implemented LEAN and Kaizen projects in government agencies and private companies receive formal lean recognition award by MPC (Malaysia Productivity Corporation, 2015).

The first MPC Lean Recognition certificates were endorsed in 2013, whereby the total of nine organisations from manufacturing, service and public sectors as the recipients. Further, the number of the Lean Recognition recipients were increasing to 24 organisations in 2014 and 42 organisations in 2015 (Malaysia Productivity Corporation, 2015, 2017). Overall, there were more than 200 organisations all over the country participated in MPC's LEAN Transformation Program and assessment with majority of them are qualified as Lean Recognition recipients. The MPC Lean Recognition certificate has three recognition levels namely Bronze, Silver and Gold. Organisations are recognised with appropriate level based on their total score in two sections of assessment, namely Lean Culture and Lean Projects.

Five criteria of Lean Culture assessment gazetted by MPC including; i) Leadership, ii) Capacity on Lean Transformation, iii) Engagement, vi) Teamwork, and v) Continual Improvement. Meanwhile, Lean Projects assessment is evaluated from the perspective of; i) status of Lean Projects, ii) aims of Lean Projects, iii) team provide project implementation plan, iv) lean tools and techniques used in Lean Projects, v) utilisation of supporting partners/stakeholders, vi) achievement of Lean Project aims, and vii) impact of the Lean Projects (e.g. time, cost, output,

quality and process metrics) (Malaysia Productivity Corporation, 2014b). The minimum score for Bronze certificate is 60%, while 70% and 80% are for Silver and Gold certificates respectively. Hence, this information concludes the Lean Manufacturing scenario and progress in Malaysia.

About Systematic Literature Review

Systematic literature review (SLR) is a comprehensive, unbiased, and reproducible review of prior studies that follows a detailed protocol (Littell, Corcoran, & Pillai, 2008). SLR originates from medical studies and spreading to social sciences that aims to provide the best evidence available from research for decision making and policy practice (Boell & Cecez-Kecmanovic, 2015). The function of a SLR is primarily to synthesize the knowledge foundation in a research field on a certain topic or research question. In short, SLR should be a robust and sensible summary of research (Furunes, 2019). Therefore, SLR is claimed to have certain key qualities that distinguish and deliver clear advantages over traditional literature reviews. The key qualities are including; transparency, replicability (reproducible) and rigor (comprehensiveness) (Liberati et al., 2009; Palmatier, Houston, & Hulland, 2018; Thomé, Scavarda, & Scavarda, 2016; Tranfield, Denyer, & Smart, 2003). While many SLR articles claimed to have these qualities, they do not define what are these qualities entailed.

Transparency is about clarity on how the knowledge (literature) was generated (Petticrew & Roberts, 2006). In the case of SLR, it means developing disseminating protocols of reviews that provide an explicit plan of the proposed work. This may include explicitly prescribes the steps and processes for searching, selecting and validating studies as well as summarizing their results (Okoli & Schabram, 2010). The use of transparent procedures that are carefully executed and documented in detail allows readers to critically appraise the search as to its adequacy. It also facilitates updates and extensions of a search (Littell et al., 2008). Transparency also can be ensured with the use of multiple reviewers to assist in selecting articles, synthesising and reporting results (Thomé et al., 2016).

Meanwhile, replicability refers to the procedures for identifying and inclusion of research articles are reproducible by others (Kitchenham & Charters, 2007; Palmatier et al., 2018). To ensure that SLR is replicable, the exact search strategy and search terms should be reported in the article with specificity and detail (Furunes, 2019; Palmatier et al., 2018). In addition, database selection when performing a systematic review should also enable replicability. Although search engine like Google Scholar has a broad outreach, replicability is difficult as two search entries would not retrieve the same results (Furunes, 2019). This is why available SLR articles on LM study used top journal publishers' database such as Springer Link, Taylor and Francis Online, ScienceDirect, Emerald Insight and IEEE Xplore (Bhamu & Singh Sangwan, 2014; Jasti & Kodali, 2014; Psomas & Antony, 2019) to enable replicability.

Lastly, rigor refers to comprehensiveness of the literature coverage (Boell & Cecez-Kecmanovic, 2015). A rigorous systematic review article must avoid from making two potential ditches that include; (1) cherry picked only articles that fit some pre-set notion, while not including articles that make significant contributions to the field, and (2) provide overview literature that offers only a mind-numbing recitation, without organization of evidence, synthetisation, or critical evaluation (Palmatier et al., 2018). As such, the present SLR groups and synthesises all reviewed articles into nine meaningful research themes to provide readers with better understanding of the focal phenomenon and offer insights for future research opportunities.

Methodology

This review article is based on SLR protocols, given that this type of review is a superior alternative to old school narrative or integrative reviews (Boell & Cecez-Kecmanovic, 2015; Furunes, 2019; Palmatier et al., 2018). Nevertheless, there are various standards and protocols for conducting and reporting systematic reviews which depends on research fields. For instance, Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) is developed for medical science and healthcare studies (Moher, Liberati, Tetzlaff, & Altman, 2009; Moher et al., 2015). Besides medical science, SLR guidelines in the field of; clinical studies (Cook, Mulrow, & Haynes, 1997), social science (Petticrew & Roberts, 2006), engineering (Kitchenham & Charters, 2007), information system (Okoli & Schabram, 2010), and hospitality and tourism (Furunes, 2019) are also available.

Meanwhile, the SLR articles in the field of LM (Albliwi, Antony, & Lim, 2015; Che Mamat, Md Deros, Ab Rahman, Omar, & Abdullah, 2015; Psomas & Antony, 2019) usually adopted SLR protocols for general management studies developed by Tranfield et al. (2003). Whereas, studies on LM are often associated to operations management (OM) field (Gurumurthy & Kodali, 2009; Jasti & Kodali, 2014; Stone, 2012). As such, Thomé et al. (2016) SLR guidelines is adopted in the present article. Thomé et al. (2016) SLR guidelines is an OM-specific SLR protocols that consist of six major steps including; (1) planning and formulating the problem, (2) searching the literature, (3) data gathering and quality evaluation, (4) search and coding reliability checks, (5) data analysis, synthesis and interpretation, and (6) presenting results and updating the review. Thus, these systematic protocols of the review are presented in this section.

Planning and Formulating the Problem

Primary elements in the first step of conducting SLR according to Thomé et al. (2016) are involving needs identification and the development of the review protocol. As stated in the Introduction section, ever since lean has entered management lexicon since the 1980s, numerous academic literatures were published and this lead to the need to organize and manage the available knowledge. Writing an SLR article is one of the ways to organize and manage the knowledge (Samuel et al., 2015; Stone, 2012). Moreover, none publication related to LM adoption in Malaysia was found so far. Hence, these issues become the needs to conduct the present SLR. Meanwhile, the review protocol to conduct the present SLR is developed based on Thomé et al. (2016) guideline that entails six steps as mentioned earlier. This protocol of course responds to specific research questions (RQs) as demanded by SLR methodologists across disciplines (Boell & Cecez-Kecmanovic, 2015; Furunes, 2019; Liberati et al., 2009; Tranfield et al., 2003).

Searching the Literature and Data Gathering

Thomé et al. (2016) recommended SLR authors to search and select literature considering six criteria as follow; (1) use appropriate databases, (2) search with relevant keywords, (3) review of abstracts, (4) select literatures using inclusion/exclusion criteria, (5) full-text review, and (6) backward and forward searches. For starter, Google Scholar is used to search articles relevant to the keyword entries since it has a broad outreach. Citation databases like Google scholar ensure a broader diversification of studies, as it can redirect to several journal and publisher databases in a single location. The same approach was taken by Bhamu and Singh Sangwan (2014) in their SLR article.

Although the focus was specific on lean adoption in manufacturing settings in Malaysia, the present SLR used four search keywords for retrieving relevant studies to fulfil SLR quality

requirement. According to Thomé et al. (2016), keywords used should be broad, but specific enough to avoid over restriction in retrieving relevant articles. Hence, the minimum of three keywords are suggested to be used (Moher et al., 2015). Thus, "Lean Manufacturing Malaysia" "Lean Production Malaysia," "*Pembuatan Kejat Malaysia*," and "*Pembuatan Lean Malaysia*" were used as the search keywords.

On the other hand, terms that are claimed to have similar meaning to LM like Toyota Production System (TPS) and JIT manufacturing (Kilpatrick, 2003; Muslimen et al., 2011; Slack, Brandon-Jones, & Johnston, 2016; Stevenson, 2018) were not used as keywords for searching the literature. The rational is; LM is an updated version of TPS, more generic usually stress the adaptation of TPS in other companies (Marodin & Saurin, 2013; Psomas & Antony, 2019). In fact, most of the papers related to TPS and JIT manufacturing are not connected to LM (Bhamu & Singh Sangwan, 2014). Literatures that particularly labelled under the "TPS" keyword (Liker, 2004; Monden, 2011; Ohno, 1988; Spear & Bowen, 1999), tend to give primary focus on Toyota Motor Company's production system (Marodin & Saurin, 2013).

All the articles retrieved from the searched results were screened properly and examined for their fit with the scope of the present SLR. Criteria taken into consideration for the screening process are including; the title, abstract, keywords, authors' affiliations and types of publication. Regarding types of publication, only scientific papers published in international journals and conference proceedings which have a peer-review process were selected. Grey literatures like thesis, dissertations, non-scientific journal articles, book chapters, and newspapers reports were not included.

Initially, 179 articles were downloaded based on above mentioned screening criteria for full-text reading. Then, inclusion/exclusion criteria as in Table 1 were applied to further short-listed the articles. After the application of the inclusion and exclusion criteria during the full-text reading, 136 articles were short-listed and recorded in MS Excel spreadsheet. This MS excel spreadsheet worked as a database to organise all selected articles (i.e. SLR database). Pilot information extracted from the short-listed articles are including; year of publication, publishers' names, journals' names, authors, and publication types.

Based on information extracted from the short-listed articles, forward searches were done. Forward search means reviewing additional sources that can be accessed from the same publisher or journal databases retrieved from the keyword search. A reiterated trend could be seen when all of the articles were sorted out according to the name of publishers and journals. The recurrence of top management science publishers like Emerald Publishing, Elsevier Ltd., Inderscience Inc., and Taylor and Francis Group were recorded in the SLR database. In fact, these publishers' databases were used in the previous literature review studies in the field of LM (Bhamu & Singh Sangwan, 2014; Jasti & Kodali, 2014; Psomas & Antony, 2019). Besides that, IEEE, IOP Science, EDP Science and Trans Tech Publications were also repeatedly recorded. Hence, the review team decided to do forward search through publisher and journal databases that retrieved more than three articles from three different authors.

Table 1: Inclusion and Exclusion Criteria

Inclusion criteria	Exclusion criteria
Journal articles and conference papers published between 2005 and 2019	Any publication before the year 2006 and after 2019
Studies that explicitly include the word 'lean' in the title or keywords	Studies that only include specific lean elements such as 'Total Productive Maintenance', 'Value Stream Mapping', 'Single Minute Exchange of Die', '5S' in the title and studies that never include the word 'lean' as one of the keywords
Studies classified under 'business', 'management', 'economics', 'social science' and 'engineering' in the database	Studies classified under 'medicine', 'physics' and 'chemistry' in the database
Studies related to lean adoption in manufacturing or production environment (including supply chain)	Studies related to lean adoption in construction, healthcare, higher education, printing, and service sector in general.
Studies that explicitly mentioned Malaysia as the setting	Studies that only authored by Malaysian/ Malaysia affiliated authors, but not done in Malaysia setting
Articles written in the English language and authors' native language (*Bahasa Melayu*)	Articles written in other than English and *Bahasa Melayu*

Applying the same inclusion/exclusion criteria (Table 1), another 56 articles were downloaded from the forward search. However, only 29 articles were selected and added into the SLR database after the full-text review. The remaining 27 articles were not included because the scope of the studies was not explicitly mentioned Malaysia as the setting. These articles were priory downloaded based on authors' affiliations. Altogether, there were 163 articles were recorded in the SLR database. In searching the literature, it is important to decide when to stop (Thomé et al., 2016). Following logical advise by Petticrew and Roberts (2006) and Levy and Ellis (2006), authors stopped searching for literatures when each new search retrieve fewer related articles than previous rounds, or retrieve the same article titles than previous rounds. Therefore, 165 articles comprised of conference proceedings (Table 2) and academic journals (Table 3) and were finalised as studied samples for the present SLR.

Table 2: List of Conference Proceedings

Publisher - Conferences	No. of articles	Percentage
Trans Tech Publications	**15**	**24.6**
Applied Mechanics and Materials	11	18.0
Advanced Materials Research	4	6.6
IOP Science	**9**	**14.8**
IOP Conference Series: Materials Science and Engineering	6	9.8
Journal of Physics: Conference Series	2	3.3
IOP Conference Series: Earth and Environmental Science	1	1.6
Elsevier	**9**	**14.8**
Procedia Engineering	4	6.6
Procedia Social and Behavioral Sciences	2	3.3
Procedia Economics and Finance	1	1.6
Procedia Manufacturing	1	1.6

IEOM Society International	**5**	**8.2**
IEOM conference series	5	8.2
EDP Sciences	**4**	**6.6**
MATEC Web of Conferences	4	6.6
Institute of Electrical and Electronics Engineers (IEEE)	**4**	**6.6**
IEE conference series	4	6.6
Malaysian universities	**3**	**4.9**
Universities conferences	3	4.9
Others	**12**	**19.7**
TOTAL	**61**	**100.0**

Table 3: List of Academic Journals

Publisher - Journals	No. of articles	Percentage
Malaysian universities	**22**	**21.6**
Jurnal Teknologi (UTM)	10	9.8
Journal of Advanced Manufacturing Technology (UTeM)	5	4.9
Journal of Technology and Operations Management (UUM)	3	2.9
International Journal of Automotive and Mechanical Engineering (UMP)	2	2.0
Asia-Pacific Journal of Information Technology and Multimedia (UKM)	1	1.0
International Journal of Integrated Engineering Management (UTHM)	1	1.0
Emerald Group Publishing	**14**	**13.7**
International Journal of Lean Six Sigma	7	6.9
The TQM Journal	2	2.0
Industrial Management & Data Systems	1	1.0
International Journal of Quality & Reliability Management	1	1.0
Journal of Modelling Management	1	1.0
Journal of Quality in Maintenance Engineering	1	1.0
Kybernetes	1	1.0
Inderscience Enterprises	**14**	**13.7**
International Journal of Productivity and Quality Management	3	2.9
International Journal of Advanced Operations Management	2	2.0
International Journal of Agile Systems and Management	2	2.0
International Journal of Manufacturing Technology and Management	2	2.0
International Journal of Industrial and Systems Engineering	1	1.0
International Journal of Quality and Innovation	1	1.0
International Journal of Services and Operations Management	1	1.0
International Journal of Value Chain Management	1	1.0
World Review of Entrepreneurship, Management and Sustainable Development	1	1.0
Taylor and Francis Group	**5**	**4.9**
International Journal of Management Science and Engineering Management	1	1.0

International Journal of Production Research	1	1.0
Journal of Asia-Pacific Business	1	1.0
Journal of Statistics and Management Systems	1	1.0
Production Planning & Control: The Management of Operations	1	1.0
ExcelingTech Publishers	**5**	**4.9**
International Journal of Supply Chain Management	5	4.9
Academic Journals Inc.	**3**	**2.9**
African Journal of Business Management	2	2.0
Research Journal of Business Management	1	1.0
Elsevier	**3**	**2.9**
Journal of Cleaner Production	3	2.9
World Academy of Science, Engineering and Technology (WoSET)	**3**	**2.9**
International Journal of Industrial and Manufacturing Engineering	1	1.0
International Journal of Mechanical, Aerospace, Industrial, Mechatronic and Manufacturing Engineering	1	1.0
Open Science Journal	1	1.0
Others	**33**	**32.4**
TOTAL	**102**	**100.0**

Quality Evaluation and Reliability Checks

Quality evaluation involves the assessment of publication bias (i.e. selective exclusion of relevant studies), inappropriate research methodology, and bias during selective reporting of primary studies (Thomé et al., 2016). Publication bias may arise if the search for literatures is only made restricted to indexed journals. As indexed journal often required longer time to publish, searching for only indexed journals may forbid recent studies to be included in the review (Rothstein & Hopewell, 2009). As such, peer-reviewed journals and reputed conferences in the area also can be considered for inclusion in the SLR (Bhamu & Singh Sangwan, 2014; Thomé et al., 2016). This is the reason why the present SLR, included not just indexed journals, but also peer-reviewed journals and proceedings from reputed conferences as listed in Table 2 and Table 3 above.

In addition, the review team consisting of the authors of this SLR, checked for any significant omissions or over-sights resulting from the selection of search keywords, type of literatures, databases, and decision to stop searching. This was to ensure that every selected article fulfilled the quality requirement and consensus decision among the authors was achieved. As every member of the review team were in agreement on all criteria to include and exclude searched literatures, inter-coder reliability also was obtained (Thomé et al., 2016).

Data Analysis, Synthesis and Interpretation

Based on the SLR database established in the previous step, a clear picture of the sample articles is provided and critically presented. The initial database was extended by adding the following fields: article types, industry sub-sectors, objectives, and main results. The fields ‘objectives’ and ‘main results’ were the main foundation to group the studies into ten meaningful research themes in LM adoption. It is worth noting that some studies were focussing on more than one theme. All information is presented from Figures 1 to Figure 4, in the Results section of this article.

Results

By searching the studies in the databases using the keywords stated in the Methodology section, 179 articles deemed to fit with the scope of the SLR were identified. Then, by reviewing the articles full text, 136 articles remained and recorded in the SLR database. From the record, authors recognised several publishers that issued multiple journals and proceedings. Hence, forward search was employed, and another 58 articles were downloaded for further review. Eventually, the application of the inclusion/exclusion criteria resulted in 163 articles that composed the present SLR (Table 4).

Table 4: Summary of Selected Articles

Steps	Number of articles
Keyword search	179
Forward search	56
Total identified (retrieved)	235
Total excluded	72
Total included (final sample)	163

The distribution of the reviewed articles among the publishers and the respective academic journals as well as proceedings is presented in Table 2 and Table 3. The studies were published in 29 different conference proceedings and 67 different international journals. Trans Tech Publications published the majority of the conference proceedings (24.6 percent), while Malaysian public universities databases published the majority of the academic journal articles (21.6 percent) among the sample articles. Meanwhile, Figure 1 charted the number of articles published per year from 2008 to 2019. According to Figure 1, the majority of the sample articles (14.5 percent) were published in 2012. On the other hand, none article published in 2006 and 2007 was found, despite the period of literature search was set to begin from 2006.

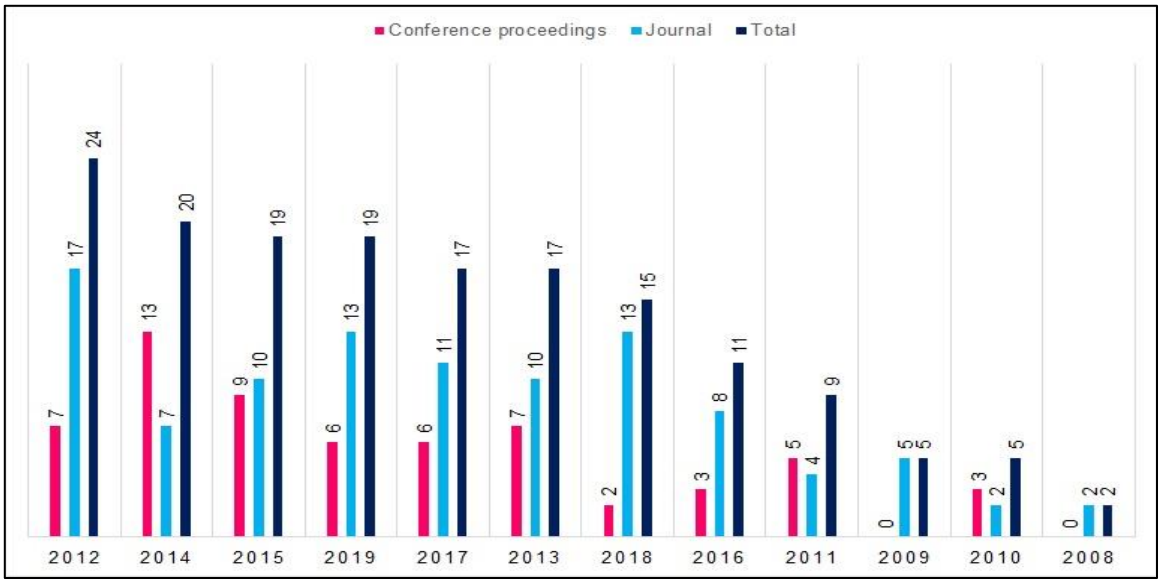

Figure 1: Articles per Publication Year

From Figure 2, about 42 percent of the sample articles describe survey studies, 36 percent case studies, 15 percent conceptual articles, 5 percent literature reviews, and finally 2 percent mixed method studies.

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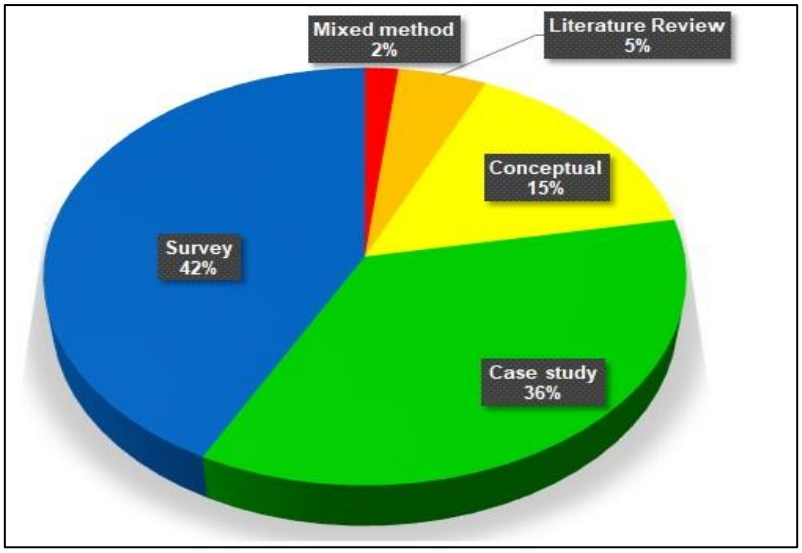

Figure 2: Article Types

Figure 3 displays the manufacturing sub-sectors examined in the empirical articles (surveys, case studies, and mixed-method) presented in the sample articles are the following: 49 automotive (37.1 percent), 28 various industries (21.2 percent), 19 electrical and electronics (14.4 percent), 9 food and beverages (6.8 percent), 6 aerospace composite (4.5 percent), and 5 anonymous (3.8 percent). Iron and steel, wood and wood-based products, machinery and equipment share the same percentage (2.3 percent). Likewise, textiles and apparel, pharmaceutical, and chemicals and petrochemical also share the equal percentage (1.5 percent).

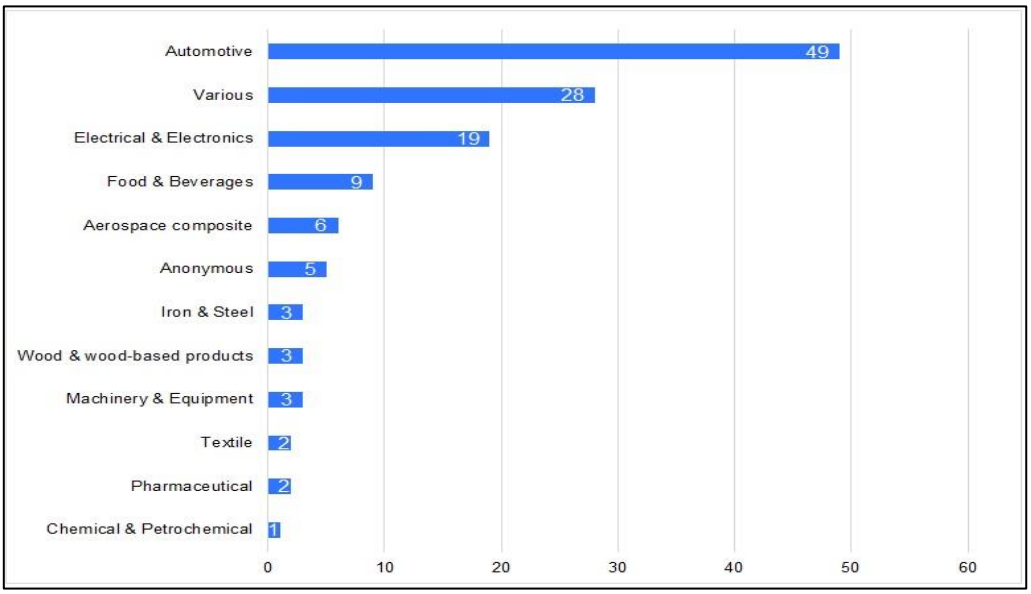

Figure 3: Manufacturing Sub-sectors

Figure 4 shows the number of the literature references supporting the research gaps of the respective themes. The themes of the research gaps which are supported by most references concern the manufacturing sub-sectors and industries where the results of LM adoption are realised (LM results), followed by the themes related to the development of LM implementation and assessment frameworks (models), LM integration with other management practices (integration), as well as factors affecting LM success (success factors), and failures

(barriers/ challenges). The rank is continued by research themes with really few references such as, LM benefits, motivations to adopt LM, LM definitions, and sustaining LM adoption.

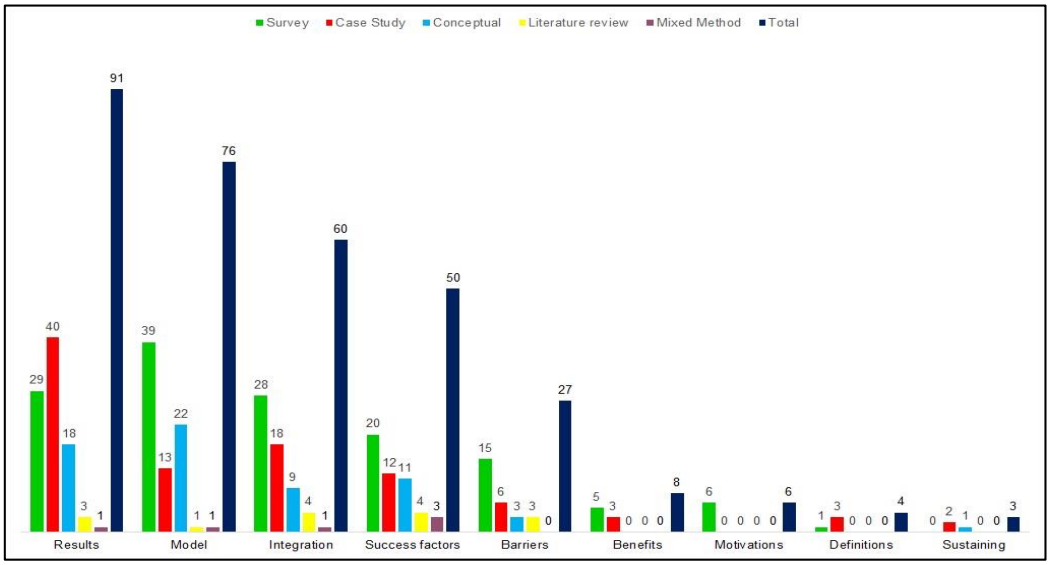

Figure 4: Number of Articles per Research Theme

Discussion and Future Research Directions

The research area categorised in a respective theme are highly inter-related. This makes each theme of research area with regard to the LM can be further classified into three sub-categories. More specifically, these sub-categories concern themes with regard to the pre-implementation phase (e.g. LM definitions, barriers, success factors, and motivations), the implementation phase (e.g. relationship between LM adoption and its results, LM implementation framework, LM assessment models, and integration of LM with other management strategy) and the post-implementation phase (e.g. lean benefits, and sustaining lean) of LM in various sub-sectors (Bhamu & Singh Sangwan, 2014; Psomas & Antony, 2019).

Lean Definitions Theme

This area comprises studies that aim to understand the principles, main concepts and the scope of lean applications. In fact, this area is very critical for LM pre-implementation phase since it helps to define what is meant by lean, and thus what practices and tools should be adopted. The definition of lean, its principles, and main concepts are known as the Lean Philosophy (Gupta & Jain, 2013). A research opportunity in this area concerns better understanding on the taxonomy of knowledge regarding LM tools, techniques, practices, principles, and thinking. Globally, there are numerous studies in which the focus was to comprehend and differentiate these terms, such as Shah and Ward (2007), Pettersen (2009), Gurumurthy and Kodali (2009), Arlbjørn and Freytag (2013), Mirdad and Eseonu (2015), and many more. In contrast, there are only four studies (Ab Rahman, A Ghani, Chan, & Abusin, 2013; Abdul Wahab, Mukhtar, & Sulaiman, 2017; Islam, Sorooshian, & Mustafa, 2018; Wong et al., 2009) in which this topic is discussed from the perspective of Malaysian LM experts and practitioners. Hence, it emphasises that there is a need to focus on Lean Philosophy studies from the perspective of Malaysian LM experts and practitioners to fill this research gap. In fact, the lack of understanding on Lean Philosophy is the common major problem impeding the success and sustainability of LM adoption (Connell, 2008; Murti, 2009; Pentlicki, 2014; Schlichting, 2009).

Sustaining LM Adoption Theme

Similar to lean definitions theme, studies on sustaining lean adoption also received very limited attention in regard to Malaysian manufacturing context. This theme entails studies that aim to comprehend how to maintain the momentum of lean adoption, once the pilots and blitzes are completed (Jørgensen, Matthiesen, Nielsen, & Johansen, 2007). Sustaining lean research theme might also be addressed as sustainable lean, lean sustainability, or lean maturity. From the international view, there were at least one published study every year that addressed this research theme since 2004 including; Veech (2004), Lucey, Bateman, and Hines (2005), Found et al. (2006), Jørgensen et al. (2007), Burch (2008), Rentes, Araujo, and Rentes (2009), Testani and Ramakrishnan (2010), Roth (2011), Zarbo (2012), Taylor, Taylor, and McSweeney (2013), Dombrowski and Mielke (2014), Wuestman and Casey (2015), Mohd Yusof and Aoki (2016), Pakdil and Leonard (2017), and Poksinska and Swartling (2018). This is because, sustaining lean adoption has become the major concern among LM scholars and practitioners worldwide (Bhasin & Burcher, 2006; Jadhav, Mantha, & Rane, 2014; Kallage, 2006; Tenescu & Teodorescu, 2014). However, only three studies regarding this theme from Malaysian manufacturing perspective are found (Habidin, Mohd Zubir, Conding, Jaya, & Hashim, 2013; Wai, Ignatius, & Keng, 2014; Wai & Wong, 2014). This scenario is suggesting that researchers need to concentrate more on sustaining lean adoption in Malaysian manufacturing settings, so that local manufacturers will not suffer the same fate as abroad manufacturers. Rationally, no more organisation will attempt to adopt LM if it is not sustainable and prone to failure.

Motivations to Adopt LM Theme

Another research theme that also received very few attentions in Malaysian manufacturing settings is motivations to adopt lean. Overall, there are only six studies found from the current database and all are survey design. In fact, two of the articles were authored by the same research team (Nordin et al., 2010b; Nordin, Md Deros, & Abd Wahab, 2011). Therefore, only five studies are considered as researching this topic (see Table 5). Although, there are only five studies were done, there is no pressing needs to heighten the number of studies, considering motivations for adopting LM is not really an important knowledge for solving critical issues in ensuring the success and sustainability of LM adoption.

Table 5: Common Motivations for Adopting LM

No	Motivations	Authors					Σ
		1	2	3	4	5	
1	To reduce wastes (e.g. inventory, downtime, scrap, rework, movement, transportation, and excess output)		X	X		X	3
2	To focus on customers (e.g. directives, demand, and satisfaction)	X		X		X	3
3	To increase flexibility	X	X				2
4	To reduce cost		X			X	2
5	To improve long term quality competitiveness			X		X	2

Authors: (1) Nordin et al. (2010b), (2) Manzouri, Ab Rahman, Saibani, and Che Mohd Zain (2013), (3) Mohd Rose, Md Deros, and Ab Rahman (2013a), (4) Shamsudin, Mohd Radzi, and Othman (2016), (5) Abu, Gholami, Mat Saman, Mohamad Zakuan, and Streimikiene (2019).

Benefits From LM Adoption Theme

LM benefit is one of many other research themes that also has very few literature supports. Previous SLR by Psomas and Antony (2019) also reported the same trend. Based on the present SLR database, only eight studies on LM benefits in the context of Malaysia manufacturing

sector have been found. The limited numbers of studies on this theme may be because other studies were addressing benefits acquired from LM adoption as the LM effects (Psomas & Antony, 2019), LM results (Marodin & Saurin, 2013) or LM performance (Bhamu & Singh Sangwan, 2014) instead. Common benefits from LM adoption identified from local literatures (see Table 6) are indeed similar to LM performance measurement indicators. For instance, productivity improvement, product quality improvement, flexibility improvement, and inventory reduction are among indicators of LM performance measures (Bhasin, 2008; Yusup, Wan Mahmood, & Salleh, 2016). Therefore, future review articles should group LM benefits together with LM results research theme (e.g. operational performance, financial performance, business performance, organisation's performance or lean performance) to avoid further misunderstanding.

Table 6: Common Benefits from LM Adoption

No	Benefits	Authors								Σ
		1	2	3	4	5	6	7	8	
1	Decreased inventory	X	X	X	X	X		X	X	7
2	Improved productivity	X	X		X	X	X		X	6
3	Improved product quality	X	X	X	X	X			X	6
4	Reduced cost (e.g. manufacturing cost, transaction cost, material handling cost, etc.)	X	X	X	X	X				5
5	Reduction in lead time		X	X		X		X	X	5
6	Reduced space requirement			X	X	X		X	X	5
	Increased profit	X		X	X					3
8	Improved flexibility (e.g. volume, product mix)	X	X	X						3
9	Improved on-time delivery record					X			X	2
10	Increased employees' satisfaction/ greater job satisfaction			X			X			2
11	Improved customer satisfaction/ reduced customer complaints			X		X				2
12	Improved worker's safety				X			X		2
13	Improved employees' lean behaviour					X		X		2
14	Improved employees' empowerment				X			X		2
15	Manpower reduction				X			X		2

Authors: (1) Wong et al. (2009), (2) Ahmad Fakhri, Muhammad Hafiz, and Mohamed (2012), (3) Manzouri (2012), (4) Ab Rahman et al. (2013), (5) Mohd Rose et al. (2013a), (6) Che Mamat, Md Deros, Ab Rahman, and Ahmad Jami (2014), (7) A. N. A. Ahmad et al. (2017a), (8) Mohd Rose, Ab Rashid, Nik Mohamed, and Ahmad (2017).

Results of Adopting LM Theme

Results from LM adoption for survey and case studies (including mixed-method case studies) are analysed and discussed separately, since case studies reported the results in more specific measurements (e.g. lead time reduction, inventory reduction, space optimisation, etc.). In comparison, survey studies tend to report the LM adoption results using latent constructs (indirect measurements) such as organisational performance, operational performance, and business performance. Table 7 and Table 8 present the results that manufacturers have acquired by using LM as well as the types of measures used for assessing the results.

Majority of the case studies reported quality improvement as the result from LM adoption. On the other hand, most survey studies used business performance measures to evaluate the LM result. However, both surveys and case studies showed the least interest in the result of LM on working conditions such as job safety improvement, job satisfaction, and job characteristics. Unlike, Malaysia's context, nationwide studies were intensely focused on these results, even negative impacts were also studied (Marodin & Saurin, 2013). Moreover, studies on the result of LM on lean culture formation are also lacking. Yet, these studies are necessary because lean culture is considered as one of the indicator of sustainable lean success (Hogan, 2009; Mann, 2015; Murti, 2009; Nooraei Ashtiani, 2016; Zarbo, 2012). Besides that, studies on LM results through survey studies has led to many types of performance construct with divergent views. For example, Roslin, Ahmed, Ahamat, Bahrom, and Ibrahim (2019) measured organisational performance as a multidimensional construct that consisted of waste reduction, financial performance, non-financial performance, and operational performance. In the same vein, Habidin, Mohd Yusof, and Mohd Fuzi (2016) also measured organisational performance from multidimensional perspective, but with different dimensions which include, financial performance, customer focus, and internal business process. In contrast, Jayaraman, Teo, and Keng (2012) only measured organisational performance as a unidimensional construct.

Therefore, one of the research opportunities in this area is concerned with the joint analysis of performance measures related to tangible and intangible results, such as operational performance and lean culture formation. Such studies would support the identification of potential synergy between the performance measures, shedding light on the contribution of LM to them. Another research opportunity is concerned with more studies of LM impact on working condition, regardless of positive or negative results. Furthermore, there is a lack of standard LM performance measures. The use of a wide variety of performance measures has led to different views devoid of concepts. Hence, there is a strong and urgent need to converge these divergent views to some standard to establish an effective performance measurement system for LM.

Table 7: Results of LM Adoption (Case Studies)

No	Results	Authors
1	Quality improvement (e.g. defects, rejects, or scrap reduction)	5, 6, 10, 13, 14, 16, 17, 18, 19, 27
2	Cost savings	8, 10, 14, 17, 18, 19, 21, 27, 31, 36
3	Value-added time/activity improvement (waste reduction)	3, 19, 20, 23, 25, 27, 29, 30, 34
4	Lead time reduction	1, 2, 4, 10, 14, 20, 25, 26,
5	Processing cycle time reduction	7, 11, 12, 19, 28, 29, 36
6	Productivity improvement (e.g. labour, OEE, work efficiency)	9, 21, 31, 32, 36, 39
7	Manpower reduction	1, 8, 9, 14, 27,
8	Inventory reduction	3, 4, 10, 14, 34
9	Changeover/ setup time reduction	7, 13, 22, 24
10	Waiting time reduction	13, 23, 30, 36
11	Timely delivery	10, 14, 17, 18
12	Space optimisation	4, 9, 14,
13	Environmental sustainability	33, 38, 40
14	Economic sustainability	35, 38

15	Societal sustainability	37, 38
16	Lean culture	15, 16
17	Safety improvement	28
18	Reduced worker's pain	39

Authors: (1) Abdul Rashid et al. (2010), (2) Esfandyari, Osman, Ismail, and Tahriri (2011), (3) Muslimen et al. (2011), (4) Naufal, Jaffar, Yusoff, and Hayati (2012), (5) Tan, Chin, Prakash, and Loh (2012), (6) Rahani and Al-Ashraf (2012), (7) Roslin, Muhammad Shahadat, Md Dawal, and Tamri (2012), (8) K. Ng, Lim, Chong, and Goh (2013), (9) Naufal, Jaffar, Yusoff, and Abdul Halim (2013), (10) Pang and Daud (2013), (11) Abdul Aziz, Ng, and Zulkifli (2014), (12) Ismail, A Ghani, Ab Rahman, Md Deros, and Che Haron (2014), (13) Mohamad et al. (2014), (14) Mohd Rusli, Jaffar, Muhamud-Kayat, and Ali (2014), (15) Puvanasvaran, HuiHui, and Norazlin (2014), (16) Sahwan, Ab Rahman, and Md Deros (2014), (17) Wai and Wong (2014), (18) Wai et al. (2014), (19) Wan Saidin, Mohd Adnan, Kasim, Mohamed Ibrahim, and Ahmad Zaidi (2014), (20) Zahraee, Hashemi, Abdi, Shahpanah, and Mohd Rohani (2014), (21) Benjamin, Marathamuthu, and Murugaiah (2015), (22) Ibrahim et al. (2015), (23) Jaffar, Kasolang, Abdul Ghaffar, Mohamad, and Mohamad (2015), (24) Mohamed Esa, Abdul Rahman, and Jamaludin (2015), (25) Mohd Rohani and Zahraee (2015), (26) Mohd Rusli, Jaffar, Muhamud-Kayat, and Ali (2015), (27) Wan Saidin, Mohd Idris, Ravi, Ahmad Zaidi, and Kasim (2015), (28) A. N. A. Ahmad et al. (2017a), (29) A. N. A. Ahmad et al. (2017b), (30) Ishak et al. (2017), (31) Wan Ibrahim, Abdul Rahman, and Abu Bakar (2017), (32) Fam, Ismail, Yanto, Prastyo, and Lau (2018), (33) Khalili, Ismail, Karim, and Che Daud (2018b), (34) Puvanasvaran, Stephanie, and Norazlin (2013), (35) Wan Mahmood, Yusup, Salleh, Muhamad, and Ab Rahman (2018), (36) Abd Wahab, Ahmad, Mustafa, Jusoh, and Din (2019), (37) Gholami et al. (2019), (38) Mohamad, Rahman, and Salleh (2019), (39) Mohd Rose, Ab Rashid, Nik Mohamed, and Jubri (2019), (40) Wei et al. (2019).

Table 8: Results of LM Adoption (Survey Studies)

No	Results	Authors
1	Business Performance	4, 8, 9, 12, 18, 21, 25
2	Operational Performance	7, 12, 14, 17, 18, 21
3	Organisational Performance	6, 7, 16, 26, 29
4	Manufacturing Performance	10, 13, 23
5	Manufacturing Sustainability Performance	15, 24, 27
6	Environmental Performance	5, 20
7	Lean Performance	11, 19
8	KPI Achievement	1, 2
9	Financial Performance	3
10	Non-financial Performance	3
11	Lean Success	22
12	Job Satisfaction	28
13	Job Characteristics	28

Authors: (1) Puvanasvaran, Megat Ahmad, Tang, Muhamad, and Hamouda (2009), (2) Puvanasvaran, Tay, et al. (2009), (3) Mohd Salleh, Kasolang, and Jaffar (2011), (4) Agus and Hajinoor (2012), (5) Bandehnezhad, Zailani, and Fernando (2012), (6) Habidin and Mohd Yusof (2012), (7) Jayaraman et al. (2012) , (8) Agus and Iteng (2013), (9) Ghobakhloo and Tang (2014), (10) Mohamed Ismail, Che Razak, and Mad Lazim (2014), (11) Yusup et al. (2014), (12) Iteng (2015), (13) Mohamed Ismail, Che Razak, and Mad Lazim (2015), (14) Raja Mohd Rasi, Rakiman, and Ahmad (2015), (15) Wan Mahmood, Yusup, Salleh, and Mohd Yusof (2015), (16) Habidin et al. (2016), (17) Iteng, Ahmad, and Abdul Rahim (2016), (18) Kader Ali, Chee, and Jayaraman (2016), (19) Yusup et al. (2016), (20) Habidin, Hibadullah, Mohd Fuzi, Salleh, and Md Latip (2017), (21) Iteng, Abdul Rahim, and Ahmad (2017), (22) Ghobakhloo, Azar, and Fathi (2018), (23) Hasan, Mohd Asaad, and Iteng (2018a), (24) Hasan, Mohd Asaad, and Iteng (2018b), (25) T. C. Ng and Ghobakhloo (2018), (26) Yoshifumi, Sammogram, and Manzuma-Ndaaba (2018), (27) Iranmanesh, Zailani, Hyun, Ali, and Kim (2019), (28) Khaw, Zailani, Iranmanesh, and Heidari (2019), (29) Roslin et al. (2019).

Barriers in LM Adoption Theme

Adopting LM in a developing country such as Malaysia is still considered to be a major challenge for manufacturing organisations due to several obstacles or barriers. It is essential for all practitioners to understand these barriers and try to overcome them. There are considerable evidences of barriers that impeding manufacturers' efforts to adopt LM. Various studies have identified many common barriers in the adoption of the LM. Overall, there are more than 20 common barriers identified from 21 empirical articles. Even so, only the top 20 barriers are presented in Table 9, with production operator's issues as the most frequently cited barrier. Opportunity for future study within this research theme may be identifying industry-specific barriers in LM adoption. Existing studies are coming from industries such as automotive (Roslin, Muhammad Shahadat, & Md Dawal, 2014; Sahwan, Ab Rahman, & Md Deros, 2012), electrical and electronics (M. F. Ahmad et al., 2017; Wong et al., 2009), food (Khusaini, Ismail, & Rashid, 2016), and furniture (Abu et al., 2019). Yet, LM is also adopted in other types of industry in Malaysia manufacturing sector including; machinery and equipment, aerospace composite, pharmaceutical, and textiles. Therefore, studies of LM barriers in such industries should be conducted to add valuable information on industry-wise LM adoption.

Table 9: Common Barriers of LM Adoption

No	Barriers	Authors
1	Production operators are unable to implement change (e.g. resisting attitude, lack of involvement, commitment, empowerment, accountability, knowledge and skill)	1, 2, 3, 4, 6, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 21
2	Budget constraints/ high investment cost/ insufficient capital funding/ limited financial support	1, 2, 3, 4, 6, 8, 10, 12, 13, 15, 16, 19, 21
3	Management issues (e.g. management change, senior managers support, commitment, and middle management attitude)	1, 2, 3, 4, 6, 9, 10, 12, 13, 15, 16, 19, 20, 21
4	Organisational/ company culture (e.g. poor working culture, cultural change issue, etc.)	1, 2, 3, 4, 6, 9, 13, 15, 17, 19, 20
5	Lack of LM knowledge (e.g. how to implement, what tools and techniques can be used)	1, 2, 3, 4, 6, 10, 13,16, 17, 19
6	Limited communication (e.g. lack of knowledge and information transfer or reluctance to exchange information)	2, 3, 5, 8, 10, 13, 15, 20, 21
7	Benefits not significant enough/ financial benefits not recognised/ inability to quantify benefits	1, 2, 3, 4, 15, 16, 19
8	Lack of time to implement/ insufficient time to improve	1, 4, ,6, 8, 15, 16, 19
9	Lack of technical and labour resources (e.g. low teachnology plant, lack of expertise and skilled workers)	6, ,9, 12, 15, 16, 19, 21
10	Lack of practice and training (e.g. no continuous training, no formal training, etc.)	4, 5, 11, 13, 15, 16, 21
11	Lack of understanding on LM concepts	6, 7, 8, 11, 15, 16, 18
12	Failure of past lean projects	1, ,4 ,5 ,6, 9
13	Issues with suppliers (e.g. no cooperation from suppliers or lack of supplier integration)	7, 9 ,10, 13, 15
14	Nature of manufacturing facility/ disparate manufacturing environment	2, ,3, 8, 15
15	Uncertainties in demand/ market competition and uncertainty/ unstable customer order	5, ,9 10, 13

16	Does not practice what is preached/ Lean is a gimmick	1, 6, 19
17	National culture/ does not fit culture	2, 3, 19
18	High turnover/ frequent quit the job	11, 12, 17
19	Lack of effective measurement criteria/ poor measurement systems	6, 9, 16
20	Backsliding to the old ways of working	1, 4

Authors: (1) Wong et al. (2009), (2) Nordin et al. (2010b), (3) Nordin, Md Deros, and Abd Wahab (2011), (4) Ahmad Fakhri et al. (2012), (5) Cheah, Wai, and Deng (2012), (6) Sahwan et al. (2012), (7) Ab Rahman et al. (2013), (8) Manzouri et al. (2013), (9) Mohd Rose, Md Deros, and Ab Rahman (2013b), (10) Che Mamat et al. (2014), (11) Hibadullah, Mohd Fuzi, Chiek Desa, Mohd Zamri, and Habidin (2013), (12) Nordin and Othman (2014), (13) Roslin et al. (2014), (14) Sahwan et al. (2014), (15) Khusaini et al. (2016), (16) M. F. Ahmad et al. (2017), (17) Mohd Rose et al. (2017), (18) San, Musa, Sedek, Abdullah, and Rahim (2018), (19) Abu et al. (2019), (20) Mustapha, Abu Hasan, and Muda (2019), (21) Shiau, Ismail, Ahmad, Zaman, and Lim (2019).

Success Factors of LM Adoption Theme

A number of studies have been conducted to identify the factors that affect the employment of LM practices. The effective manipulation of these factors, to the possible extent, is critical for successful LM adoption. Table 10 shows the studies and 16 common factors they have identified. Among the factors that influence LM adoption success, 60% of the studies mention the importance of top management leadership. Previous SLR by Marodin and Saurin (2013) also demonstrated a similar trend for global LM adoption. Some research opportunities in this theme that can be emphasised, including a more detailed description of the factors that influence LM success, by investigating whether those factors are vary or common with respect to organisation's context. With the existing studies on this theme were mostly from automotive manufacturers context, there is a need for studying other organisation's context like machinery and equipment, food, furniture, pharmaceutical, or textiles industry. Besides that, it is interesting to further compare those factors between different manufacturing industry, since some studies highlighted that nature of manufacturing facility or disparate manufacturing environment hinder the success of LM adoption (Khusaini et al., 2016; Manzouri et al., 2013; Nordin et al., 2010b).

Table 10: Common Success Factors of LM Adoption

No	Success Factors	Authors
1	Top management leadership (e.g. mind set, support, commitment, engagement, change readiness and willingness)	1, 2, 5, 6, 8, 9, 10, 11, 12, 13, 14, 16, 18, 19, 20, 25, 26, 28, 30, 31, 35
2	Employee training program (e.g. cross-functional training, workshops, sharing sessions, continuous learning, education, skills, tacit knowledge, etc.)	1, 2, 3, 4, 5, 7, 9, 12, 18, 19, 20, 22, 23, 24, 25, 28, 29, 30, 33, 35
3	Employee involvement (e.g. work attitude, change readiness, suggestion scheme, problem solving)	3, 4, 5, 6, 7, 10, 11, 13, 15, 18, 19, 25, 26, 28, 30, 31, 34
4	Effective communication (e.g. frequent communication, knowledge transfer, best practices sharing, success stories, awareness and promotion, latest lean information updates, understanding individual role, lean tools and techniques, etc.)	5, 6, 9, 11, 12, 16, 18, 19, 20, 21, 22, 25, 29, 31, 32
5	Employee's empowerment	1, 2, 3, 4, 5, 6, 7, 10, 25, 28, 31, 34, 35

6	Teamwork development (e.g. group problem solving)	1, 2, 3, 4, 5, 6, 7, 10, 11, 25, 31, 35
7	Reward and recognition system (employee's motivation)	5, 7, 9, 19, 22, 23, 25, 28, 29, 30, 33
8	Review system (e.g. goal's measurement, benchmarking, etc.)	5, 6, 8, 9, 14, 16, 25
9	Supplier management (e.g. vendor participation, supplier relationship, supply chain-wide integration, etc.)	8, 13, 14, 15, 28, 35
10	Strategic planning (e.g. lean vision, strategic direction, fusing business strategy with lean strategy	4, 10, 22, 29, 33, 35
11	Lean work culture (e.g. lean thinking, act lean, problem solving, etc.)	7, 16, 19, 28, 30, 33
12	IT competency	17, 19, 27, 28, 31
13	Customer focus/ Customer relations	8, 14, 15, 33, 35
14	Financial resources/ financial capability/ implementation costs	19, 20, 28, 31
15	Structured improvement procedures	8, 14, 33, 35
16	Change agent system	5, 6, 10, 25

Authors: (1) Puvanasvaran et al. (2008), (2) Puvanasvaran, Megat Ahmad, Tang, and Muhamad (2009), (3) Puvanasvaran, Megat Ahmad, Tang, Muhamad, et al. (2009), (4) Puvanasvaran, Tay, et al. (2009), (5) Nordin, Md Deros, and Abd Wahab (2010a), (6) Nordin, Md Deros, Abd Wahab, and Ab Rahman (2011), (7) Wong and Wong (2011), (8) Habidin and Mohd Yusof (2012), (9) Jayaraman et al. (2012), (10) Nordin, Md Deros, Abd Wahab, and Ab Rahman (2012), (11) Roslin et al. (2012), (12) Ab Rahman et al. (2013), (13) Abdul Rahman, Mohd Sharif, and Mohamed Esa (2013), (14) Habidin and Mohd Yusof (2013), (15) Hibadullah, Habidin, Mohd Zamri, Mohd Fuzi, and Chiek Desa (2014), (16) Nordin and Othman (2014), (17) Puvanasvaran et al. (2014), (18) Wai et al. (2014), (19) Bon and Tan (2015), (20) Kader Ali et al. (2016), (21) Shamsudin et al. (2016), (22) Khalili, Ismail, Karim, and Che Daud (2017), (23) M. F. Ahmad et al. (2017), (24) Mohamed and Nordin (2017), (25) Nordin and Md Deros (2017), (26) Wan Ibrahim et al. (2017), (27) Ghobakhloo, Azar, et al. (2018), (28) Ghobakhloo, Fathi, Fontes, and Ng (2018), (29) Khalili et al. (2018b), (30) San et al. (2018), (31) T. C. Ng and Ghobakhloo (2018), (32) Johan and Mohd Tarli (2019), (33) Mustapha et al. (2019), (34) Roslin et al. (2019), (35) Shiau et al. (2019).

LM Models Theme

The studies classified in this theme focused on developing framework to effectively implement LM and/or assessment models to evaluate the degree and impact of LM implementation. Frameworks for effective LM implementation were mostly established through case studies using qualitative data (see Table 10). On the other hand, LM assessment models were mostly developed based on statistical evidence from survey studies (see Table 11). Statistical analysis like structural equation modelling (SEM) were often used. There were also few case studies which developed LM assessment models based on decision science tools such as; Analytical Hierarchy Process (AHP), Interpretive Structural Modelling (ISM), Analytical Network Process (ANP), and simulation software. Simulations involve mathematical modelling of production processes, with the aim of assessing LM impacts on certain performance metrics. The low use of simulation models by LM assessment literature can be due to the fact that LM key practices are human and culture-related, thus resistant to mathematical modelling (Marodin & Saurin, 2013). 96% of the studies used only one source of evidence for collecting the data for developing LM models. Only two studies used more than one source of evidence (Ghobakhloo, Fathi, et al., 2018; Nordin & Md Deros, 2017). Therefore, future studies on LM model development should emphasize the use of multiple sources of evidence, since it allows for data triangulation that draw more meaningful conclusions (Jasti & Kodali, 2014; Marodin & Saurin, 2013).

Table 10: LM Models (Case Studies)

No	Models	Authors
1	Implementation framework	2, 3, 6, 7, 10, 11, 14,
2	Interpretive Structural Modeling (ISM)	4, 8, 13,
3	Analytical Network Process (ANP)	8, 9
4	Analytical Heirarchy Process (AHP)	1, 16
5	Simulation (Delmia Quest)	5, 15
6	Standard Multiple Regression	12
7	Structural Equation Modelling (SEM)	13

Authors: (1) Mohd Nawawi, Khan, and Hussain (2008), (2) Mohamad and Ito (2011), (3) Wong and Wong (2011), (4) Cheah et al. (2012), (5) Mohd Salleh, Kasolang, and Jaffar (2012d), (6) Nordin et al. (2012), (7) Mohd Rusli et al. (2014), (8) Wai and Wong (2014), (9) Wai et al. (2014), (10) Abdul Wahab, Mukhtar, Sulaiman, et al. (2017), (11) Nordin and Md Deros (2017), (12) Fam et al. (2018), (13) Ghobakhloo, Fathi, et al. (2018), (14) Khalili et al. (2018b), (15) Mohd Rose et al. (2019), (16) Wei et al. (2019).

Table 11: LM Models (Survey Studies)

No	Models	Authors
1	Structural Equation Modelling (SEM)	5, 6, 11, 12, 18, 21, 25, 26, 27, 32, 34, 38
2	Partial Least Square-SEM (PLS-SEM)	14, 17, 19, 23, 29, 30, 31, 36, 37
3	Standard Multiple Regression	1, 2, 4, 7, 22, 24, 33, 35,
4	Descriptive statistics	8, 9, 10, 13, 20, 39
5	Spearman Correlation	1, 2, 3, 4,
6	Step-wise Multiple Regression	1, 2, 4
7	Rasch	15, 16
8	Principal component	28

Authors: (1) Puvanasvaran et al. (2008), (2) Puvanasvaran, Megat Ahmad, Tang, and Muhamad (2009), (3) Puvanasvaran, Megat Ahmad, Tang, Muhamad, et al. (2009), (4) Puvanasvaran, Tay, et al. (2009), (5) Agus and Hajinoor (2012), (6) Habidin and Mohd Yusof (2012), (7) Jayaraman et al. (2012), (8) Mohd Salleh, Kasolang, and Jaffar (2012a), (9) Mohd Salleh, Kasolang, and Jaffar (2012b), (10) Mohd Salleh, Kasolang, and Jaffar (2012c), (11) Agus and Iteng (2013), (12) Habidin and Mohd Yusof (2013), (13) Mohd Salleh, Kasolang, Jaffar, and Ismail (2013), (14) Ghobakhloo and Tang (2014), (15) Khusaini, Jaffar, and Yusoff (2014a), (16) Khusaini, Jaffar, and Yusoff (2014b), (17) Mohamed Ismail et al. (2014), (18) Iteng (2015), (19) Mohamed Ismail et al. (2015), (20) Mohd Salleh, Kasolang, Jaffar, and Abdul Halim (2015), (21) Habidin et al. (2016), (22) Iteng et al. (2016), (23) Kader Ali et al. (2016), (24) Shamsudin et al. (2016), (25) Yusup et al. (2016), (26) Habidin et al. (2017), (27) Iteng et al. (2017), (28) Khalili, Ismail, Karim, et al. (2017), (29) Ghobakhloo, Azar, et al. (2018), (30) Hasan et al. (2018a), (31) Hasan et al. (2018b), (32) Khalili et al. (2018b), (33) San et al. (2018), 34) T. C. Ng and Ghobakhloo (2018), (35) Yoshifumi et al. (2018), (36) Iranmanesh et al. (2019), (37) Khaw et al. (2019), (38) Roslin et al. (2019), (39) Shiau et al. (2019).

LM Integration with Other Management Systems Theme

Integration of LM with other management systems or concepts was deemed to produce better results when compare to standalone LM practices. Evidence from local literatures depicted that LM had been integrated with more than ten different concepts (see Table 12). The most common integration was with six sigma methodology, which is known as the lean six sigma (LSS). On the contrary, integration of LM with Good Manufacturing Practices (GMP) and Islamic concept were the scarcest. From strategic view, any concept that provides customer value and emphasises on waste elimination can be in line with a lean philosophy. In fact, technology applications and quality management practices like ERP, MRP, QMS, and TQM have been used in conjunction with LM since the beginning of global LM development (Dal

Pont, Furlan, & Vinelli, 2008; Shah & Ward, 2003). Thus, these concepts are already considered as the subsets of LM practices and was the reason why scholars did not exclusively mention the integration.

Moreover, studies on LM integration with supply chain management, i.e. lean supply chain management (LSCM) also had very limited attention, unlike LM worldwide studies. Hence, this trend is implying that there is a need to focus on LSCM practices, as supplier's involvement is considered as one of the factors for sustaining LM success (Ghobakhloo, Fathi, et al., 2018; Mohd Yusof & Aoki, 2016; Shiau et al., 2019; Sisson & Elshennawy, 2015). Another interesting research opportunity in regards to this theme is concerning further discussion on alignment between lean philosophy with Islamic teachings. Jaffar et al. (2015) attempted to leverage Islamic values to elevate the awareness and acceptance of LM strategy among SME business owners in rural areas. However, the reported outcome only provided limited knowledge as the study was still in preliminary stage. Based on Islamic teaching, waste is considered as the devil's habit. Through several verses in the Holy Quran, Allah The Almighty commands humankind not to commit excess and spend wastefully:

O children of Adam, take your adornment at every masjid, and eat and drink, but be not excessive. Indeed, He likes not those who commit excess [Surah Al-A'raf 7:31] (Sahih International, 1997).

And give the relative his right, and [also] the poor and the traveller, and do not spend wastefully. Indeed, the wasteful are brothers of the devils, and ever has Satan been to his Lord ungrateful [Surah Al-Isra 17:26, 27] (Sahih International, 1997).

As per the growing interest, association between lean philosophy and other religious teachings like Shintoism, Buddhism, Confucianism (Wittrock, 2015), and Christianity (Vance, 2017) were also being studied. Therefore, lean scholars should conduct more study related to theoretical linkage between lean philosophy and religious teachings to add more new insights on lean body of knowledge.

Table 12: LM integrations with other systems

No	Systems/ Concepts	Authors
1	Six sigma (6 σ)	3, 4, 11, 17, 26, 27, 38, 43
2	Total Quality Management (TQM)	1, 7, 8, 9, 10, 31, 35, 36
3	Environmental Management System (EMS)	3, 7, 8, 9, 12, 33, 35
4	Manufacturing technology (e.g. ERP, MRP, CAD, CAM etc.)	6, 15, 16, 18, 23
5	Information and Technology Management	7, 19, 20, 33, 37
6	Green manufacturing/ Cleaner production	21, 30, 41, 44
7	Sustainable development concept (Triple Bottom Line)	25, 34, 39, 40
8	Supply Chain Management (SCM)	2, 5, 13
9	Quality Management System - QMS (e.g. ISO/TS16949, ISO 14001, etc.)	1, 29, 35
10	Ergonomics	28, 42
11	Good manufacturing practice (GMP)	32
12	Islamic teachings	22

Authors: (1) Mohd Salleh et al. (2011), (2) Agus and Hajinoor (2012), (3) Habidin and Mohd Yusof (2012), (4) Jayaraman et al. (2012), (5) Manzouri (2012), (6) Mohamed Ismail and Wee (2012), (7) Mohd Salleh et al.

(2012a), (8) Mohd Salleh et al. (2012b), (9) Mohd Salleh et al. (2012c), (10) Mohd Salleh et al. (2012d), (11) Tan et al. (2012), (12) Puvanasvaran, Swee, Suresh, and Muhamad (2012), (13) Manzouri et al. (2013), (14) Mohd Salleh et al. (2013), (15) Pang and Daud (2013), (16) Ghobakhloo and Tang (2014), (17) Ismail et al. (2014), (18) Mohamed Ismail et al. (2014), (19) Nordin and Othman (2014), (20) Puvanasvaran et al. (2014), (21) Yusup et al. (2014), (22) Jaffar et al. (2015), (23) Mohamed Ismail et al. (2015), (24) Mohd Salleh et al. (2015), (25) Wan Mahmood et al. (2015), (26) Habidin et al. (2016), (27) Kader Ali et al. (2016), (28) Mohd Yusuff and Abdullah (2016), (29) Habidin et al. (2017), (30) Ishak et al. (2017), (31) Khalili, Ismail, and Karim (2017), (32) Wan Ibrahim et al. (2017), (33) Ghobakhloo, Azar, et al. (2018), (34) Hasan et al. (2018b), (35) Khalili, Ismail, Karim, and Che Daud (2018a), (36) Khalili et al. (2018b), (37) T. C. Ng and Ghobakhloo (2018), (38) Abd Wahab et al. (2019), (39) Gholami et al. (2019), (40) Iranmanesh et al. (2019), (41) Mohamad et al. (2019), (42) Mohd Rose et al. (2019), (43) Mustapha et al. (2019), (44) Wei et al. (2019).

Conclusion

The absence of efforts to organize and manage the enormous number of literatures on LM studies in Malaysia has motivated the authors of the present article to systematically review the literature focusing on the research gaps of LM. This article compiles a review of 163 scholarly articles on LM adoption published during 2008 to 2019. The review contributes to the literature by highlighting various LM research gaps and presenting them systematically according to nine meaningful research themes and prioritizing these themes based on the number of the supporting references. Following conclusions can be drawn from the review:

- The LM research in Malaysia had emerged from year 2008, although the first lean transformation was deployed in 2006.
- Automotive industry had been the primary setting of the research, but LM was also adopted by other type of industries including, electrical and electronics, food and beverages, machinery and equipment, textile, furniture, paper, and plastic (toy manufacturing).
- The most literature retrieved were empirical articles, with survey studies as the majority (42%), followed by case studies (36%), and mixed method studies (2%). There were only 15% conceptual articles and 5% literature review articles were found.
- Across industries, employees' issues (e.g. resistance, lack of knowledge, skill, and accountability) were the major barriers in LM adoption. Meanwhile, LM success depended largely on the top management leadership in the organizations.
- Product quality improvement and cost saving were the common results realised from LM case studies. On the other hand, most survey studies portrayed LM adoption had significant effect on business and operational performance.
- Most LM assessment models were tested using statistical analysis (e.g. SEM, PLS-SEM, and regression), but psychometric assessment method (i.e. Rasch Model), decision science tools (e.g. AHP, ANP, and ISM), and simulation software were rarely employed.
- Studies on lean definitions, sustainable LM adoption, impact of LM on working conditions, and integration of LM with supply chain management in Malaysia's context were really lacking, compare to the trend of global studies.

References

Ab Rahman, M. N., A Ghani, J., Chan, K. H., & Abusin, M. A. A. (2013). Pembentukan TPS dalam pembuatan lean: Satu kajian perbandingan. *Jurnal Teknologi, 63*(1), 21-33.

Abd Wahab, I., Ahmad, R., Mustafa, S. A., Jusoh, M. S. J., & Din, M. S. (2019). Improvement on Bill of Materials formatting process by adopting lean and six sigma approaches – A case study in a semiconductor industry. *International Journal of Integrated Engineering Management, 11*(8), 81-90.

Abdul Aziz, F., Ng, W. L., & Zulkifli, N. (2014). *Development of lean production system for air filter manufacturer using value stream mapping.* Paper presented at the Applied Mechanics and Materials, Kuala Lumpur, MY.

Abdul Rahman, N. A., Mohd Sharif, S., & Mohamed Esa, M. (2013). *Lean manufacturing case study with kanban system implementation.* Paper presented at the International Conference on Economics and Business Research 2013 (ICEBR 2013), UiTM, Kedah.

Abdul Rashid, A. H., Shaari, M. F., Mohamad Zakuan, N., & Hasan Basri, N. F. (2010). *Lean manufacturing assessment in Malaysia small medium enterprise: A case study*. Paper presented at the Conference on Manufacturing & Technology Management, Sarawak, Malaysia.

Abdul Wahab, A. N., Mukhtar, M., & Sulaiman, R. (2017). Lean production system definition from the perspective of Malaysian industry. *Asia-Pacific Journal of Information Technology and Multimedia, 6*(1).

Abdul Wahab, A. N., Mukhtar, M., Sulaiman, R., Kamarudin, S., Ang, M. C., & Jenal, R. (2017). Validating the relationship between lean dimensions and wastes: A pilot study of Malaysian industries. *International Journal of Engineering Sciences and Research Technology (IJESRT), 6*(7).

Abu, F., Gholami, H., Mat Saman, M. Z., Mohamad Zakuan, N., & Streimikiene, D. (2019). The implementation of lean manufacturing in the furniture industry: A review and analysis on the motives, barriers, challenges, and the applications. *Journal of Cleaner Production, 234*, 660-680.

Agus, A., & Hajinoor, M. S. (2012). Lean production supply chain management as driver towards enhancing product quality and business performance: Case study of manufacturing companies in Malaysia. *International Journal of Quality & Reliability Management, 29*(1), 92-121. doi:10.1108/02656711211190891

Agus, A., & Iteng, R. (2013). Lean production and business performance: The moderating effect of the length of lean adoption. *Journal of Economics, Business and Management, 1*(4), 324-328.

Ahmad, A. N. A., Lee, T. C., Ramlan, R., Ahmad, M. F., Husin, N., & Abdul Rahim, M. (2017a). *The hybrid lean system to improve manufacturing environment.* Paper presented at the MATEC Web of Conferences 135, Langkawi, Malaysia.

Ahmad, A. N. A., Lee, T. C., Ramlan, R., Ahmad, M. F., Husin, N., & Abdul Rahim, M. (2017b). *Value stream mapping to improve workplace to support lean environment.* Paper presented at the 8th International Conference on Mechanical and Manufacturing Engineering 2017 (ICME'17), Langkawi, Malaysia.

Ahmad Fakhri, S., Muhammad Hafiz, J., & Mohamed, A. R. (2012). *The implementation of lean manufacturing in Malaysian automotive industry.* Paper presented at the Advanced Materials Research.

Ahmad, M. F., Toh, L. Y., Chan, S. W., Ahmad, A. N. A., Raja Mohd Rasi, R. Z., Abdul Rahman, N. A., . . . Hashim, F. A. (2017). *Continuous improvement and its barriers in electrical and electronic industry.* Paper presented at the MATEC Web of Conferences 135, Langkawi, Malaysia.

Albliwi, S. A., Antony, J., & Lim, S. A. H. (2015). A systematic review of Lean Six Sigma for the manufacturing industry. *Business Process Management Journal, 21*(3), 665-691.

Arlbjørn, J. S., & Freytag, P. V. (2013). Evidence of lean: A review of international peer-reviewed journal articles. *European Business Review, 25*(2), 174-205.

Bandehnezhad, M., Zailani, S., & Fernando, Y. (2012). An empirical study on the contribution of lean practices to environmental performance of the manufacturing firms in northern region of Malaysia. *International Journal of Value Chain Management, 6*(2), 144-168. doi:10.1504/IJVCM.2012.048379

Becker, R. M. (1998). Lean manufacturing and the Toyota Production System *Encyclopedia of World Biography*. Detroit, MI: Gale Research Inc.

Benjamin, S. J., Marathamuthu, M. S., & Murugaiah, U. (2015). The use of 5-WHYs technique to eliminate OEE's speed loss in a manufacturing firm. *Journal of Quality in Maintenance Engineering, 21*(4), 419-435.

Bhamu, J., & Singh Sangwan, K. (2014). Lean manufacturing: Literature review and research issues. *International Journal of Operations & Production Management, 34*(7), 876-940.

Bhasin, S. (2008). Lean and performance measurement. *Journal of Manufacturing Technology Management, 19*(5), 670-684.

Bhasin, S., & Burcher, P. (2006). Lean viewed as a philosophy. *Journal of manufacturing technology management, 17*(1), 56-72.

Bicheno, J., & Holweg, M. (2009). *The lean toolbox: The essential guide to lean transformation* (4th Ed.). Buckingham, United Kingdom: PICSIE Books.

Boell, S. K., & Cecez-Kecmanovic, D. (2015). On being 'systematic' in literature reviews in IS. *Journal of Information Technology, 30*, 161-173.

Bon, A. T., & Tan, S. K. (2015). *Implementation of lean manufacturing for productivity improvement in Malaysia.* Paper presented at the 2015 International Conference on Industrial Engineering and Operations Management (IEOM), Dubai, UAE.

Burch, M. K. (2008). *Lean longevity: Kaizen events and determinants of sustainable improvement.* (Doctor of Philosophy in Business Administration), University of Massachusetts Amherst, Boston, MA.

Che Mamat, R., Md Deros, B., Ab Rahman, M. N., & Ahmad Jami, N. (2014). Employees' perception on lean production system implementation: A case of Malaysia automotive component manufacturer. *Applied Mechanics and Materials, 660*, 1032-1037.

Che Mamat, R., Md Deros, B., Ab Rahman, M. N., Omar, M. K., & Abdullah, S. (2015). Soft lean practices for successful lean production system implementation in Malaysia automotive SMEs. *Jurnal Teknologi, 77*(27), 141-150. doi:10.11113/jt.v77.6910

Cheah, A. C. H., Wai, P. W., & Deng, Q. (2012). *Challenges of lean manufacturing implementation: A hierarchical model.* Paper presented at the The 3rd International Conference on Industrial Engineering and Operations Management (IEOM2012), Istanbul, Turkey.

Connell, P. (2008). *Promoting and sustaining lean initiatives.* (Master of Leadership (MLS)), University of Southern Maine, Maine, USA.

Cook, D. J., Mulrow, C. D., & Haynes, R. B. (1997). Systematic reviews: synthesis of best evidence for clinical decisions. *Annals of Internal Medicine, 126*(5), 376-380.

Dal Pont, G., Furlan, A., & Vinelli, A. (2008). Interrelationships among lean bundles and their effects on operational performance. *Operations Management Research, 1*(2), 150-158.

Dombrowski, U., & Mielke, T. (2014). Lean leadership: 15 rules for a sustainable lean implementation. *Procedia CIRP, 17*, 565-570.

Esfandyari, A., Osman, M. R., Ismail, N., & Tahriri, F. (2011). Application of value stream mapping using simulation to decrease production lead time: A Malaysian manufacturing case. *International Journal of Industrial and Systems Engineering, 8*(2), 230-250.

Fam, S., Ismail, N., Yanto, H., Prastyo, D., & Lau, B. (2018). Lean manufacturing and Overall Equipment Efficiency (OEE) in paper manufacturing and paper products industry. *Journal of Advanced Manufacturing Technology (JAMT), 12*(1 (2)), 461-474.

Found, P., Beale, J., Hines, P., Naim, M., Rich, N., Sarmiento, R., & Thomas, A. (2006). A theoretical framework for economic sustainability of manufacturing. *Cardiff University Innovative Manufacturing Research Centre: UK*.

Furunes, T. (2019). Reflections on systematic reviews: Moving golden standards? *Scandinavian Journal of Hospitality and Tourism, Editorial*, 1-5.

Ghobakhloo, M., Azar, A., & Fathi, M. (2018). Lean-green manufacturing: The enabling role of information technology resource. *Kybernetes, 47*(9), 1752-1777.

Ghobakhloo, M., Fathi, M., Fontes, D. B. M. M., & Ng, T. C. (2018). Modeling lean manufacturing success. *Journal of Modelling in Management, 13*(4), 908-931.

Ghobakhloo, M., & Tang, S. H. (2014). IT investments and business performance improvement: The mediating role of lean manufacturing implementation. *International Journal of Production Research, 52*(18), 5367-5384.

Gholami, H., Jamil, N., Mohamad Zakuan, N., Mat Saman, M. Z., Sharif, S., Awang, S. R., & Sulaiman, Z. (2019). Social Value Stream Mapping (Socio-VSM): Methodology to societal sustainability visualization and assessment in the manufacturing system. *IEEE Access, 7*, 131638-131648.

Gupta, S., & Jain, S. K. (2013). A literature review of lean manufacturing. *International Journal of Management Science and Engineering Management, 8*(4), 241-249.

Gurumurthy, A., & Kodali, R. (2009). Development of a framework for lean manufacturing systems. *International Journal of Services and Operations Management, 5*(5), 687-716.

Habidin, N. F., Hibadullah, S. N., Mohd Fuzi, N., Salleh, M. I., & Md Latip, N. A. (2017). Lean manufacturing practices, ISO 14001, and environmental performance in Malaysian automotive suppliers. *International Journal of Management Science and Engineering Management*, 1-9.

Habidin, N. F., Mohd Yusof, S., & Mohd Fuzi, N. (2016). Lean six sigma, strategic control systems, and organizational performance for automotive suppliers. *International Journal of Lean Six Sigma, 7*(2), 110-135.

Habidin, N. F., & Mohd Yusof, S. r. (2012). Relationship between lean six sigma, environmental management systems, and organizational performance in the Malaysian automotive industry. *International Journal of Automotive Technology, 13*(7), 1119-1125.

Habidin, N. F., & Mohd Yusof, S. r. (2013). Critical success factors of lean six sigma for the Malaysian automotive industry. *International Journal of Lean Six Sigma, 4*(1), 60-82.

Habidin, N. F., Mohd Zubir, A. F., Conding, J., Jaya, N. A. S. L., & Hashim, S. (2013). Sustainable manufacturing practices, sustaining lean improvements and sustainable performance in Malaysian automotive industry. *World Review of Entrepreneurship, Management and Sustainable Development, 9*(4), 444-459. doi:10.1504/WREMSD.2013.056755.

Hasan, M. Z., Mohd Asaad, M. N., & Iteng, R. (2018a). Ethical climates as a moderator on the relationship between lean manufacturing practices and manufacturing performance using PLS-SEM. *International Research Journal of Engineering and Technology (IRJET), 6*(5), 6740-6750.

Hasan, M. Z., Mohd Asaad, M. N., & Iteng, R. (2018b). The mediating role of manufacturing performance on the relationship between lean manufacturing practices and sustainability. *Journal of Information System and Technology Management, 3*(7), 45-54.

Hibadullah, S. N., Habidin, N. F., Mohd Zamri, F. I., Mohd Fuzi, N., & Chiek Desa, A. F. N. (2014). Critical success factors of lean manufacturing practices for the Malaysian automotive manufacturers. *International Journal of Quality and Innovation, 2*(3-4), 256-271.

Hibadullah, S. N., Mohd Fuzi, N., Chiek Desa, A. F. N., Mohd Zamri, F. I., & Habidin, N. F. (2013). Lean manufacturing practices and environmental performance in Malaysian automotive industry. *Asian Journal of Finance & Accounting, 5*(1), 462-471.

Hogan, B. J. (2009, December 1st, 2016). Sustaining a lean culture. *Manufacturing Engineering Magazine, 143*, 71-76.

Ibrahim, M. A., Mohamad, E., Arzmi, M. H., A Rahman, M. A., Saptari, A., Shibghatullah, A. S., . . . Md Ali, M. A. (2015). Enhancing efficiency of die exchange process through single minute of exchanging die at a textile manufacturing company in Malaysia. *Journal of Applied Sciences, 15*(3), 456-464.

Iranmanesh, M., Zailani, S., Hyun, S. S., Ali, M. H., & Kim, K. (2019). Impact of lean manufacturing practices on firms' sustainable performance: Lean culture as a moderator. *Sustainability, 11*(4), 1112.

Ishak, A., Mohamad, E., Sukarma, L., Mahmood, A. R., Rahman, M. A., Yahya, S., . . . Sulaiman, M. (2017). Cleaner production implementation using extended value stream mapping for enhancing the sustainability of lean manufacturing. *Journal of Advanced Manufacturing Technology (JAMT), 11*(1 (1)), 47-60.

Islam, A. T., Sorooshian, S., & Mustafa, S. (2018). What lean is really about: Malaysian automotive perspective. *International Journal of Recent Technology and Engineering (IJRTE), 7*(4S2), 441-447.

Ismail, A., A Ghani, J., Ab Rahman, M. N., Md Deros, B., & Che Haron, C. H. (2014). Application of Lean Six Sigma tools for cycle time reduction in manufacturing: Case study in biopharmaceutical industry. *Arabian Journal for Science and Engineering, 39*(2), 1449-1463.

Iteng, R. (2015, 2nd– 4th October). *Lean production and performance in Malaysian manufacturing industries.* Paper presented at the The 11th Proceedings Asian Academy of Management International Conference 2015 – Embracing Innovation and Creativity: Towards Sustainability and Inclusive Growth Penang, Malaysia

Iteng, R., Abdul Rahim, M. K. I., & Ahmad, M. A. (2017). Lean production and business performance in Malaysian manufacturing industries. *International Journal of Supply Chain Management, 6*(2), 250-255.

Iteng, R., Ahmad, M. A., & Abdul Rahim, M. K. I. (2016). The impact of technically oriented lean production practices on operational performances in Malaysian
manufacturing industries. *Journal of Technology and Operations Management, 12*(1), 56-66.

Jadhav, J. R., Mantha, S., & Rane, S. B. (2014). Development of framework for sustainable lean implementation: An ISM approach. *Journal of Industrial Engineering International, 10*(3), 72.

Jaffar, A., Kasolang, S., Abdul Ghaffar, Z., Mohamad, N. S., & Mohamad, M. K. F. (2015). Management of seven wastes: A case study in an automotive vendor. *Jurnal Teknologi, 76*(6).

Jasti, N. V. K., & Kodali, R. (2014). A literature review of empirical research methodology in lean manufacturing. *International Journal of Operations & Production Management, 34*(8), 1080-1122.

Jasti, N. V. K., & Kodali, R. (2015). Lean production: Literature review and trends. *International Journal of Production Research, 53*(3), 867-885.

Jayaraman, K., Teo, L. K., & Keng, L. S. (2012). The perceptions and perspectives of Lean Six Sigma (LSS) practitioners: An empirical study in Malaysia. *The TQM Journal, 24*(5), 433-446. doi:10.1108/02656711211190873

Johan, Z. J., & Mohd Tarli, S. M. (2019). Lean production determinant factors in Malaysia paper manufacturer industry. *International Journal of Supply Chain Management, 8*(2), 977-981.

Jørgensen, F., Matthiesen, R., Nielsen, J., & Johansen, J. (2007). Lean maturity, lean sustainability. In J. Olhager & F. Persson (Eds.), *Advances in Production Management*

Systems (pp. 371-378). Aalborg, Denmark: IFIP International Federation for Information Processing.

Kader Ali, N., Chee, W. C., & Jayaraman, K. (2016). Critical success factors of Lean Six Sigma practices on business performance in Malaysia. *International Journal of Productivity and Quality Management, 17*(4), 456-473.

Kallage, R. G. (2006). Lean implementation failures. *Stamping Journal, 18*(7), 26-29. Retrieved from http://www.thefabricator.com/article/shopmanagement/lean-implementation-failures

Khalili, A., Ismail, M. Y., & Karim, A. (2017). Integration of lean manufacturing and quality management system through structural equation modelling. *International Journal of Productivity and Quality Management, 20*(4), 534-556.

Khalili, A., Ismail, M. Y., Karim, A., & Che Daud, M. R. (2017). Critical success factors for soft TQM and lean manufacturing linkage. *Jordan Journal of Mechanical & Industrial Engineering, 11*(2).

Khalili, A., Ismail, M. Y., Karim, A., & Che Daud, M. R. (2018a). A conceptual framework linking LM, TQM, QMS, and EMS practices with the SP: Assessment of responses from managers of some Malaysian industries. *International Journal of Manufacturing Technology and Management, 32*(3), 191-214.

Khalili, A., Ismail, M. Y., Karim, A., & Che Daud, M. R. (2018b). Soft total quality management and lean manufacturing initiatives: Model development through structural equation modelling. *International Journal of Productivity and Quality Management, 23*(1), 1-30.

Khaw, S. M., Zailani, S., Iranmanesh, M., & Heidari, S. (2019). Do lean manufacturing practices have negative impact on job satisfaction? *International Journal of Lean Six Sigma, 10*(1), 257-274.

Khusaini, N. S., Ismail, A., & Rashid, A. (2016). *Investigation of the prominent barriers to lean manufacturing implementation in Malaysian food and beverages industry using Rasch Model.* Paper presented at the IOP Conference Series: Material Science and Engineering 114, Kuala Lumpur, Malaysia.

Khusaini, N. S., Jaffar, A., & Yusoff, N. (2014a). *A survey on lean manufacturing practices in Malaysian food and beverages industry.* Paper presented at the Applied Mechanics and Materials, Kuala Lumpur, MY.

Khusaini, N. S., Jaffar, A., & Yusoff, N. (2014b). *A survey on lean manufacturing tools implementation in Malaysian food and beverages industry using rasch model.* Paper presented at the Advanced Materials Research, Johor Bahru, MY.

Kilpatrick, J. (2003). Lean principles. *Utah Manufacturing Extension Partnership*, 1-5.

Kitchenham, B., & Charters, S. (2007). Guidelines for performing systematic literature reviews in software engineering.

Koenigsaecker, G. (2012). *Leading the lean enterprise transformation* (2nd Ed.). Boca Raton, FL: CRC Press.

Krafcik, J. F. (1988). Triumph of the lean production system. *MIT Sloan Management Review, 30*(1), 41.

Lean Enterprise Institute, L. E. I. (2014). *Lean lexicon: A graphical glossary for lean thinkers* (5th ed.). Cambridge, MA: Lean Enterprise Institute (LEI) Inc.

Levy, Y., & Ellis, T. J. (2006). A systems approach to conduct an effective literature review in support of information systems research. *Informing Science, 9*.

Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gøtzsche, P. C., Ioannidis, J. P., . . . Moher, D. (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: Explanation and elaboration. *PLoS Medicine, 6*(7), e1000100.

Liker, J. K. (2004). *The Toyota way: 14 management principles from the world's greatest manufacturer* (1st ed.). New York, USA: McGraw-Hill Education.

Littell, J. H., Corcoran, J., & Pillai, V. (2008). *Systematic reviews and meta-analysis*. New York, NY: Oxford University Press.

Lucey, J., Bateman, N., & Hines, P. (2005). Why major lean transitions have not been sustained. *Management Services, 49*(2), 9-13.

Malaysia Productivity Corporation, M. P. C. (2014a). Creanova LEAN 2014. *Just lean, 1*.

Malaysia Productivity Corporation, M. P. C. (2014b). *Lean approach to business management and public sector*. Selangor, Malaysia: Malaysia Productivity Corporation (MPC).

Malaysia Productivity Corporation, M. P. C. (2015). Creanova LEAN. *Just lean, 1*.

Malaysia Productivity Corporation, M. P. C. (2017). *Recognition of Lean Management practice*. Retrieved from Selangor, Malaysia:

Mann, D. W. (2015). *Creating a lean culture: Tools to sustain lean conversions* (3rd ed.). Boca Raton, FL: CRC Press.

Manzouri, M. (2012). How lean supply chain implementation affect halal food companies. *Advances in Natural and Applied Sciences, 6*(8), 1485-1490.

Manzouri, M., Ab Rahman, M. N., Saibani, N., & Che Mohd Zain, C. R. (2013). Lean supply chain practices in the halal food. *International Journal of Lean Six Sigma, 4*(4), 4-4.

Marodin, G. A., & Saurin, T. A. (2013). Implementing lean production systems: Research areas and opportunities for future studies. *International Journal of Production Research, 51*(22), 6663-6680.

Mirdad, W. K., & Eseonu, C. I. (2015). A conceptual map of the lean nomenclature: Comparing expert classification to the lean literature. *Engineering Management Journal, 27*(4), 188-202.

Mohamad, E., Ab Rasid, S. N. F., Ito, T., Md Ali, M. A., Sulaiman, M. A., Azam, M. A., & Saptari, A. (2014). *An initiative to implement lean manufacturing using value stream mapping in textile manufacturing company.* Paper presented at the 24th Design Engineering Systems Division JSME Conference, Tokushima, Japan.

Mohamad, E., & Ito, T. (2011). *University-industry collaboration in lean manufacturing implementation.* Paper presented at the Proceedings of 2nd Asian Conference on Engineering Education, Tokushima, Japan.

Mohamad, E., Rahman, I. U., & Salleh, M. R. (2019). *Developing the framework of kanban system for Malaysia's small medium enterprises.* Paper presented at the 29th Design Engineering Systems Division JSME Conference, Sendai, Miyagi Prefecture.

Mohamad Zakuan, N., & Mat Saman, M. Z. (2009). Lean manufacturing concept: The main factor in improving manufacturing performance–a case study. *International Journal of Manufacturing Technology and Management, 17*(4), 353-363.

Mohamed Ariff, T. F., & Ahmed, S. (2005). *Making the lean manufacturing supply chain leap across small and medium scale industries (SMIs) in Malaysia.* Paper presented at the Proceedings of the International Conference on Recent Advances in Mechanical & Materials Engineering (ICRAMME 05), Universiti Malaya, Kuala Lumpur.

Mohamed Esa, M., Abdul Rahman, N. A., & Jamaludin, M. (2015). *Reducing high setup time in assembly line: A case study of automotive manufacturing company in Malaysia.* Paper presented at the 2nd Global Conference on Business and Social Science-2015 (GCBSS-2015), Bali, Indonesia.

Mohamed Ismail, R., Che Razak, R., & Mad Lazim, H. (2014). *Manufacturing technology impact on environmental factors and manufacturing performance.* Paper presented at the Applied Mechanics and Materials, Penang, MY.

Mohamed Ismail, R., Che Razak, R., & Mad Lazim, H. (2015). Mediating impact of manufacturing technology, lean and strategic flexibility on manufacturing performance. *Jurnal Teknologi, 77*(4).

Mohamed Ismail, R., & Wee, H. S. (2012). Manufacturing technology adoption among lean manufacturers: An initial study. *Journal of Technology and Operations Management 7*(1), 55-61.

Mohamed, R., & Nordin, N. (2017). Development of tacit knowledge in lean management in an organization: The case of automotive industry in Malaysia. *Journal of Technology and Operations Management* (Special), 1-10.

Mohd Nawawi, M. K., Khan, M. K., & Hussain, K. (2008). Knowledge-based collaborative lean manufacturing management (KBCLMM) system. *Journal of KONBiN, 8*(1), 145-156.

Mohd Rohani, J., & Zahraee, S. M. (2015). *Production line analysis via value stream mapping: A lean manufacturing process of color industry.* Paper presented at the 2nd International Materials, Industrial, and Manufacturing Engineering Conference, MIMEC2015, Bali, Indonesia.

Mohd Rose, A. N., Ab Rashid, M. F. F., Nik Mohamed, N. M. Z., & Ahmad, H. (2017). *Similarities of lean manufacturing approaches implementation in SMEs towards the success: Case study in the automotive component industry.* Paper presented at the MATEC Web of Conferences 87, Sarawak, Malaysia.

Mohd Rose, A. N., Ab Rashid, M. F. F., Nik Mohamed, N. M. Z., & Jubri, M. (2019). *The implementation of lean manufacturing and ergonomics in Small Medium Enterprise–Case study.* Paper presented at the IOP Conference Series: Materials Science and Engineering 702, Kuantan, Pahang.

Mohd Rose, A. N., Md Deros, B., & Ab Rahman, M. N. (2013a). Lean manufacturing perceptions and actual practice among Malaysian SME's in automotive industry. *International Journal of Automotive and Mechanical Engineering, 7*, 820.

Mohd Rose, A. N., Md Deros, B., & Ab Rahman, M. N. (2013b). *Lean manufacturing practices implementation in Malaysian's SME automotive component industry.* Paper presented at the Applied Mechanics and Materials, Batu Pahat, Johor.

Mohd Rusli, M. H., Jaffar, A., Muhamud-Kayat, S., & Ali, M. T. (2014). *Implementation of lean manufacturing through supplier kaizen framework: A case study.* Paper presented at the Proceedings of the 2014 International Conference on Industrial Engineering and Operations Management, Bali, Indonesia.

Mohd Rusli, M. H., Jaffar, A., Muhamud-Kayat, S., & Ali, M. T. (2015). *Selection criterion of production methods used in the kanban pull system at Malaysian auto suppliers.* Paper presented at the 2015 International Conference on Industrial Engineering and Operations Management (IEOM), Dubai, UAE.

Mohd Salleh, N. A., Kasolang, S., & Jaffar, A. (2011). Lean TQM automotive factory model system. *World Academy of Science, Engineering and Technology, 55*, 627-633.

Mohd Salleh, N. A., Kasolang, S., & Jaffar, A. (2012a). *Green lean total quality information management in Malaysian automotive companies.* Paper presented at the International Symposium on Robotics and Intelligent Sensors 2012 (IRIS 2012), Kuching, Sarawak.

Mohd Salleh, N. A., Kasolang, S., & Jaffar, A. (2012b). Green lean TQM human resource management practices in Malaysian automotive companies. *International Journal of Mechanical, Aerospace, Industrial, Mechatronic and Manufacturing Engineering, 70*(224), 340-344.

Mohd Salleh, N. A., Kasolang, S., & Jaffar, A. (2012c). Green Lean TQM practices in Malaysian automotive companies. *International Journal of Industrial and Manufacturing Engineering, 70*, 1214-1220.

Mohd Salleh, N. A., Kasolang, S., & Jaffar, A. (2012d). *Simulation of integrated total quality management (TQM) with lean manufacturing (LM) practices in forming process using Delmia Quest.* Paper presented at the International Symposium on Robotics and Intelligent Sensors 2012 (IRIS 2012), Kuching, Sarawak.

Mohd Salleh, N. A., Kasolang, S., Jaffar, A., & Abdul Halim, N. H. (2015). Lean TQM leadership management practices in Malaysian automotive companies. *Jurnal Teknologi, 76*(6).

Mohd Salleh, N. A., Kasolang, S., Jaffar, A., & Ismail, A. (2013). *Green Lean TQM suppliers, organization and customers management practices in Malaysian automotive companies.* Paper presented at the Applied Mechanics and Materials, Malacca, MY.

Mohd Yusof, S. r., & Aoki, K. (2016, March 8-10). *Proposed lean sustained factors.* Paper presented at the The 6th International Conference on Industrial Engineering and Operations Management (IEOM 2016), Kuala Lumpur, Malaysia.

Mohd Yusuff, R., & Abdullah, N. S. (2016). *Ergonomics as a lean manufacturing tool for improvements in a manufacturing company.* Paper presented at the The 6th International Conference on Industrial Engineering and Operations Management (IEOM2016), Kuala Lumpur, Malaysia.

Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2009). Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *Annals of Internal Medicine, 151*(4), 264-269.

Moher, D., Shamseer, L., Clarke, M., Ghersi, D., Liberati, A., Petticrew, M., . . . Stewart, L. A. (2015). Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Systematic Reviews, 4*(1), 1.

Monden, Y. (2011). *Toyota Production System: An integrated approach to just-in-time* (4th ed.). Boca Raton, FL: Productivity Press.

Murti, Y. (2009). *Sustaining lean in New Zealand manufacturing organisations.* (Master of Technology in Engineering and Industrial Management), Massey University, Palmerston North, New Zealand.

Muslimen, R., Mohd Yusof, S., & Zainal Abidin, A. S. (2011). *Lean manufacturing implementation in Malaysian automotive components manufacturer: A case study.* Paper presented at the Proceedings of the World Congress on Engineering 2011, London, United Kingdom.

Mustapha, M. R., Abu Hasan, F., & Muda, M. S. (2019). Lean Six Sigma implementation: Multiple case studies in a developing country. *International Journal of Lean Six Sigma, 10*(1), 523-539.

Naufal, A. A., Jaffar, A., Yusoff, N., & Abdul Halim, N. H. (2013). *Implementation of continuous flow system in manufacturing operation.* Paper presented at the Applied Mechanics and Materials, Malacca, MY.

Naufal, A. A., Jaffar, A., Yusoff, N., & Hayati, N. (2012). *Development of kanban system at local manufacturing company in Malaysia: Case study.* Paper presented at the International Symposium on Robotics and Intelligent Sensors 2012 (IRIS 2012), Kuching, Sarawak.

Ng, K., Lim, C., Chong, K. E., & Goh, G. (2013). *Elimination of waste through value add/non value add process analysis to improve cost productivity in manufacturing—A case study.* Paper presented at the 2013 IEEE International Conference on Industrial Engineering and Engineering Management, Hong Kong, HK.

Ng, T. C., & Ghobakhloo, M. (2018). What determines lean manufacturing implementation? A CB-SEM model. *Economies, 6*(1), 9.

Nooraei Ashtiani, N. (2016). *Building a sustainable lean culture: A holistic lean leadership model.* (Master of Applied Science in Industrial Engineering), Concordia University, Montreal, Quebec, Canada.

Nordin, N., & Md Deros, B. (2017). Organisational change framework for lean manufacturing implementation. *International Journal of Supply Chain Management, 6*(3), 309-320.

Nordin, N., Md Deros, B., & Abd Wahab, D. (2010a). *Relationship between organizational change and lean manufacturing implementation in Malaysian automotive industry.* Paper presented at the The 14th Asia Pacific Regional Meeting of International Foundation for Production Research, Malacca, Malaysia.

Nordin, N., Md Deros, B., & Abd Wahab, D. (2010b). A survey on lean manufacturing implementation in Malaysian automotive industry. *International Journal of Innovation, Management and Technology, 1*(4), 374-380.

Nordin, N., Md Deros, B., & Abd Wahab, D. (2011). Lean manufacturing implementation in Malaysian automotive industry: An exploratory study. *Operations and Supply Chain Management: An International Journal, 4*(1), 21-30. doi:10.31387/oscm090053

Nordin, N., Md Deros, B., Abd Wahab, D., & Ab Rahman, M. N. (2011). *Managing change in lean manufacturing implementation.* Paper presented at the Advanced Materials Research.

Nordin, N., Md Deros, B., Abd Wahab, D., & Ab Rahman, M. N. (2012). Validation of lean manufacturing implementation framework using Delphi technique. *Jurnal Teknologi, 59*, 1-6.

Nordin, N., & Othman, G. (2014). *Technology management in lean manufacturing implementation: A case study.* Paper presented at the International Symposium on Technology Management and Emerging Technologies (ISTMET), 2014 Bandung, Indonesia.

Ohno, T. (1988). *Toyota Production System: Beyond large-scale production*. Boca Raton, FL: CRC Press.

Okoli, C., & Schabram, K. (2010). A guide to conducting a systematic literature review of information systems research. *Sprout: Working Papers on Information Systems, 1026*.

Pakdil, F., & Leonard, K. M. (2017). Implementing and sustaining lean processes: The dilemma of societal culture effects. *International Journal of Production Research, 55*(3), 700-717.

Palmatier, R. W., Houston, M. B., & Hulland, J. (2018). Review articles: purpose, process, and structure. *Journal of the Academy of Marketing Science, 46*, 1-5.

Pang, C. K., & Daud, Y. (2013). *Effectiveness of enterprise resource planning system in supporting the lean manufacturing.* Paper presented at the Applied Mechanics and Materials, Batu Pahat, Johor.

Pentlicki, J. H. (2014). *Barriers and success strategies for sustainable lean manufacturing implementation: A qualitative case study.* (Doctor of Management in Organizational Leadership), University of Phoenix, Arizona, USA.

Pettersen, J. (2009). Defining lean production: some conceptual and practical issues. *The TQM Journal, 21*(2), 127-142.

Petticrew, M., & Roberts, H. (2006). *Systematic reviews in the social sciences: A practical guide*. Oxford, UK: Blackwell Publishing Ltd.

Poksinska, B., & Swartling, D. (2018). From successful to sustainable lean production: The case of a Lean Prize Award Winner. *Total Quality Management & Business Excellence, 29*(9), 996-1011.

Psomas, E., & Antony, J. (2019). Research gaps in lean manufacturing: A systematic literature review. *International Journal of Quality & Reliability Management, 36*(5), 815-839.

Puvanasvaran, A. P., HuiHui, Y., & Norazlin, N. (2014). Managing waste elimination database in Lean manufacturing: Improve problem solving capability. *American Journal of Engineering and Applied Sciences, 7*(2), 271.

Puvanasvaran, A. P., Megat Ahmad, M. H., Tang, S. H., & Muhamad, M. R. (2009). The roles of communication process for an effective lean manufacturing implementation. *Journal of Industrial Engineering and Management, 2*(1), 128-152. doi:10.3926/jiem..v2n1.p128-152

Puvanasvaran, A. P., Megat Ahmad, M. H., Tang, S. H., Muhamad, M. R., & Hamouda, A. M. (2009). Lean behavior in implementing lean process management. *Journal of Applied Scienes Research, 5*(8), 930-943.

Puvanasvaran, A. P., Stephanie, T., & Norazlin, N. (2013). Study on streamlined process improvement by using value stream mapping in automotive seating company - A case study. *Journal of Advanced Manufacturing Technology (JAMT), 7*(2).

Puvanasvaran, A. P., Swee, R. K., Suresh, V., & Muhamad, M. R. (2012). Lean principles adoption in environmental management system (EMS)-ISO 14001. *Journal of Industrial Engineering and Management, 5*(2), 406.

Puvanasvaran, A. P., Tan, B. H., Megat Ahmad, M. H., Tang, S. H., Muhamad, M. R., & Hamouda, A. M. (2008). Degree of leanness and managerial commitment in an aerospace company. *Journal of Statistics and Management Systems, 11*(4), 653-673.

Puvanasvaran, A. P., Tay, C. C., Megat Ahmad, M. H., Tang, S. H., Mohd Yusuff, R., Muhamad, M. R., & Hamouda, A. M. (2009). Leanness achievement through people development system in implementing lean process management. *American Journal of Engineering and Applied Sciences, 2*(1), 105.

Rahani, A., & Al-Ashraf, M. (2012). *Production flow analysis through value stream mapping: a lean manufacturing process case study.* Paper presented at the International Symposium on Robotics and Intelligent Sensors 2012 (IRIS 2012) Kuching, Sarawak.

Raja Mohd Rasi, R. Z., Rakiman, U. S., & Ahmad, M. F. (2015). *Relationship between lean production and operational performance in the manufacturing industry.* Paper presented at the IOP Conference Series: Material Science and Engineering 83, Bali, Indonesia.

Rentes, A. F., Araujo, C. A. C., & Rentes, V. C. (2009). *Best practice examples in sustaining improvements from Lean implementation.* Paper presented at the Proceedings of the 2009 Industrial Engineering Research Conference (IeRC), Marriott Resort, Miami.

Roslin, E. N., Ahmed, S., Ahamat, M. A., Bahrom, M. Z., & Ibrahim, N. (2019). The impact of employee involvement and empowerment in lean manufacturing system implementation towards organizational performances. *International Journal on Advanced Science, Engineering and Information Technology, 9*(1), 188-193.

Roslin, E. N., Muhammad Shahadat, S. A., & Md Dawal, S. Z. (2014). *Discovering barriers of lean manufacturing system implementation in Malaysian automotive industry.* Paper presented at the Advanced Materials Research, Johor Bahru, MY.

Roslin, E. N., Muhammad Shahadat, S. A., Md Dawal, S. Z., & Tamri, N. (2012). Strategies for the successful lean manufacturing implementation: A case study in a Malaysian automotive parts manufacturing. *International Journal of Engineering Research and Technology (IJERT), 1*(9), 1-6.

Roth, G. (2011). Sustaining lean transformation through growth and positive organizational change. *Journal of Enterprise Transformation, 1*(2), 119-146.

Rothstein, H. R., & Hopewell, S. (2009). Grey literature. In H. Cooper, L. V. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta-analysis*. New York, NY: Russell Sage Foundation.

Sahih International. (1997). *The Quran*: Saheeh International (1997).

Sahwan, M. A., Ab Rahman, M. N., & Md Deros, B. (2012). Barriers to implement lean manufacturing in malaysian automotive industry. *Jurnal Teknologi, 59*(2), 107-110. doi:10.11113/jt.v59.2571

Sahwan, M. A., Ab Rahman, M. N., & Md Deros, B. (2014). *Case studies on the implementation of lean manufacturing in the automotive malaysian companies.* Paper presented at the Applied Mechanics and Materials, Putrajaya, MY.

Samuel, D., Found, P., & Williams, S. J. (2015). How did the publication of the book The Machine That Changed The World change management thinking? Exploring 25 years of lean literature. *International Journal of Operations & Production Management, 35*(10), 1386-1407.

San, C. H., Musa, H., Sedek, M., Abdullah, M. M., & Rahim, A. (2018). *Implementation of 5S in manufacturing industry: A case of foreign workers in Melaka.* Paper presented at the MATEC Web of Conferences 150, Georgetown, Penang.

Schlichting, C. (2009). *Sustaining lean improvements.* (Master of Science in Manufacturing Engineering), Worcester Polytechnic Institute, Worcester, MA.

Shah, R., & Ward, P. T. (2003). Lean manufacturing: Context, practice bundles, and performance. *Journal of Operations Management, 21*(2), 129-149.

Shah, R., & Ward, P. T. (2007). Defining and developing measures of lean production. *Journal of operations management, 25*(4), 785-805.

Shamsudin, S., Mohd Radzi, N. I., & Othman, R. (2016). Causal ambiguity in lean production implementation in Malaysia. *Journal of Asia-Pacific Business, 17*(3), 249-266.

Shiau, W. C., Ismail, F., Ahmad, M., Zaman, I., & Lim, H. Q. (2019). Factors and barriers influencing lean production system adoption in manufacturing industries. *International Journal of Supply Chain Management, 8*(2), 939.

Sisson, J., & Elshennawy, A. (2015). Achieving success with lean. *International Journal of Lean Six Sigma, 6*(3), 263-280.

Slack, N., Brandon-Jones, A., & Johnston, R. (2016). *Operations management* (8th ed.). Harlow, United Kingdom: Pearson Education Ltd.

Spear, S., & Bowen, H. K. (1999). Decoding the DNA of the Toyota production system. *Harvard Business Review, 77*, 96-108.

Stevenson, W. J. (2018). *Operations Management* (13th ed.). New York, NY: McGraw-Hill Education.

Stone, K. B. (2012). Four decades of lean: A systematic literature review. *International Journal of Lean Six Sigma, 3*(2), 112-132.

Tan, P. Y., Chin, J. F., Prakash, J., & Loh, W. P. (2012). Reducing electronic component losses in lean electronics assembly with Six Sigma approach. *International Journal of Lean Six Sigma, 3*(3), 206-230.

Taylor, A., Taylor, M., & McSweeney, A. (2013). Towards greater understanding of success and survival of lean systems. *International Journal of Production Research, 51*(22), 6607-6630.

Tenescu, A., & Teodorescu, M. (2014). Lean manufacturing: A concept towards a sustainable management. *Communications in Applied Sciences, 2*(1), 97.

Testani, M. V., & Ramakrishnan, S. (2010). *The role of leadership in sustaining a lean transformation.* Paper presented at the Proceedings of the 2010 Industrial Engineering Research Conference (IeRC), Springfield, MO.

Thomé, A. M. T., Scavarda, L. F., & Scavarda, A. J. (2016). Conducting systematic literature review in operations management. *Production Planning & Control, 27*(5), 408-420.

Tracey, M. W., & Flinchbaugh, J. (2009). How human resource department can help lean transformation. In A. M. E. Association for Manufacturing Excellence (Ed.), *Sustaining lean: Case studies in transforming culture* (pp. 119-128). Boca Raton, FL: CRC Press.

Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *British journal of management*, *14*(3), 207-222.

Vance, G. A. (2017). *Lean behaviors for sustaining the implementation of lean methodologies in multi-national companies: A qualitative case study.* (Doctor of Business Administration), Liberty University, Lynchburg, Virginia, USA.

Veech, D. S. (2004). A person-centered approach to sustaining a lean environment: Job design for self-efficacy. *Defense Acquisition Review Journal*, 159-170.

Wai, P. W., Ignatius, J., & Keng, L. S. (2014). What is the leanness level of your organisation in lean transformation implementation? An integrated lean index using ANP approach. *Production Planning & Control*, *25*(4), 273-287.

Wai, P. W., & Wong, K. Y. (2014). Synergizing an ecosphere of lean for sustainable operations. *Journal of Cleaner Production*, *85*, 51-66.

Wan Ibrahim, W. M. K., Abdul Rahman, M., & Abu Bakar, M. R. (2017). *Implementing lean manufacturing in Malaysian small and medium startup pharmaceutical company.* Paper presented at the IOP Conference Series: Material Science and Engineering, Kuala Lumpur, Malaysia.

Wan Mahmood, W. H., Yusup, M. Z., Salleh, M. R., & Mohd Yusof, A. S. (2015). The relation between manufacturing sustainability and lean production in Malaysian industries: An initial study. *Applied Mechanics & Materials*, *761*, 560-565.

Wan Mahmood, W. H., Yusup, M. Z., Salleh, M. R., Muhamad, M. R., & Ab Rahman, M. N. (2018). Simulation modelling for lean production: Case study. *Journal of Advanced Manufacturing Technology (JAMT)*, *12*(1 (2)), 223-232.

Wan Saidin, W. A. N., Mohd Adnan, N. A., Kasim, N. I., Mohamed Ibrahim, A., & Ahmad Zaidi, A. M. (2014). *Realizing lean concept in automotive parts production: Child parts in sub-assembly line.* Paper presented at the Applied Mechanics and Materials, Bandung, IN.

Wan Saidin, W. A. N., Mohd Idris, A. Z., Ravi, S., Ahmad Zaidi, A. M., & Kasim, N. I. (2015). *Detection of nut welding using poka-yoke roller coaster jig.* Paper presented at the Applied Mechanics and Materials, Malacca, MY.

Wei, D. L., Sin, Y. T., Bing, S. H., Ngan, S. L., Hon, L. L., Chee, P. T., & Ponnambalam, S. (2019). Adaptive analytical approach to lean and green operations. *Journal of Cleaner Production*, *235*, 190-209.

Wittrock, C. (2015). Reembedding Lean: The Japanese cultural and religious context of a world changing management concept. *International Journal of Sociology*, *45*(2), 95-111.

Womack, J. P., Jones, D. T., & Roos, D. (1990). *Machine that changed the world*. New York, NY: Simon & Schuster.

Wong, Y. C., & Wong, K. Y. (2011). *A lean manufacturing framework for the Malaysian electrical and electronics industry.* Paper presented at the 3rd International Conference on Information and Financial Engineering (ICIFE 2011), Shanghai, China.

Wong, Y. C., Wong, K. Y., & Ali, A. (2009). A study on lean manufacturing implementation in the Malaysian electrical and electronics industry. *European Journal of Scientific Research, Vol.38*(4), 521-535.

Wuestman, D., & Casey, J. (2015). Lean leadership: Sustaining long-term process change. *Strategic Finance*, *97*(2), 15-61.

Yoshifumi, H., Sammogram, S., & Manzuma-Ndaaba, N. M. (2018). Effect of Productivity and Perceived Quality on Organizational Performance from Lean Management Practice Perspective. *Management*, *12*(1), 1-9.

Yusup, M. Z., Wan Mahmood, W. H., & Salleh, M. R. (2016). Implementation of lean practices based on Malaysian manufacturers' perspective: A confirmatory factor analysis. *International Journal of Advanced Operations Management, 8*(2), 105-139.

Yusup, M. Z., Wan Mahmood, W. H., Salleh, M. R., & Mohd Yusof, A. S. (2014). The adoption of lean and cleaner production: A preliminary study for Malaysia manufacturing industry. *Applied Mechanics and Materials, 660*, 949-953.

Zahraee, S. M., Hashemi, A., Abdi, A. A., Shahpanah, A., & Mohd Rohani, J. (2014). Lean manufacturing implementation through value stream mapping: A case study. *Jurnal Teknologi*, *68*(3), 119-124.

Zarbo, R. J. (2012). Creating and sustaining a lean culture of continuous process improvement. *American Journal of Clinical Pathology, 138*(3), 321-326.