

## A Trail to Milieu Research Methodology for Application of Implementation Frameworks in Manufacturing Sector

Muhammad Zeeshan Rafique<sup>a\*</sup>, Mohd Nizam Ab Rahman<sup>b</sup>, Nizaroyani Saibani<sup>b</sup> & Norhana Arsad<sup>c</sup>

<sup>a</sup>Department of Mechanical Engineering, Faculty of Engineering & Technology, The University of Lahore, Lahore, Pakistan

<sup>b</sup>Centre for Materials Engineering and Smart Manufacturing, Faculty of Engineering & Built Environment, Universiti Kebangsaan Malaysia, Selangor, Malaysia

<sup>c</sup>Centre of Advanced Electronic and Communication Engineering, Faculty of Engineering & Built Environment, Universiti Kebangsaan Malaysia, Malaysia

\*Corresponding author: muhammadzeeshanrafique@gmail.com

Received 17 October 2019, Received in revised form 24 February 2020

Accepted 10 April 2020, Available online 30 November 2020

### ABSTRACT

*The profusely used tools of operational management research in lean manufacturing context include roadmap, conceptual model, implementation frameworks, descriptive planning and assessment checklist. Out of these, an implementation framework development in lean manufacturing sector is common, but faces quandary regarding its development, consolidation and validation – thereby confirming the requirement of availability of succinct platform that aids in research methodology development. The aim of this research is to attain a clear research context, achieved accordingly by detailed literature review study that would subsequently aid in developing a generic research methodology design framework. Concomitant to it, the four layers, the layers of research onion were discussed; followed by selection of appropriate methods for development of research methodology in order to arrive at implementation frameworks. It was observed that for the methodology development, the philosophy of pragmatism is highly suitable, followed by abductive logic, in case of technique, mixed mode research is best, whereas in strategy selection, case study strategy is the most suitable due to its multi-functional ability of in-depth operational study. In addition to that, the mixed-mode approach carries the ability of comparative qualitative and quantitative research through longitudinal and cross-sectional case study respectively. Furthermore, the data collection processes were discussed in relevance to the research objective, which culminated in the formation of a detailed research methodology which has been divided into three major stages of research context and approach, framework development and validation, resulting in attaining implementation framework through literature review, longitudinal case study and cross-sectional case study respectively. The major strength and contribution of this research study is the development of one concise research methodology that is considered as the paradigm shift and a clear innovation towards this field.*

*Keywords: Literature review; research methodology; operational management; implementation framework; lean manufacturing*

### INTRODUCTION

Nowadays, the philosophy of lean manufacturing is profusely employed in manufacturing industries because of its exceptional capability of waste detection (Martinez-Jurado & Moyano-Fuentes, 2014; Moyano-Fuentes & Sacristan-Diaz 2012; Sahwan, Ab Rahman, & Deros 2012; Susilawati, Tan, Bell, & Sarwar 2015; Xiu-xu & Lin-yan 2009), which is very helpful in differentiating between value added and non-value added activities in on-going operations (Hines, Holweg, & Rich 2004; Holweg 2007; Rose, Deros, & Rahman 2014; Wahab, Mukhtar, & Sulaiman 2013). Therefore, the highly competitive market trends demand the utilization of lean concepts in manufacturing sector to cope with various challenges. However, the implementation of lean is a challenging task (Rafique, Ab Rahman, Saibani, &

Arsad 2017; Rafique, Ab Rahman, Saibani, Arsad, & Saadat 2016) and in order to meet those challenges, there are various start-ups available for research in operations management of manufacturing sector, which include roadmap, conceptual model, implementation frameworks, descriptive planning and assessment checklist. However, especially for the case of lean manufacturing, implementation framework is deemed the most suitable and frequently utilized, as suggested by many previous researchers (Jasti & Kodali 2015; N. V. K. Jasti & R. Kodali 2015; Jasti & Kodali 2016; Ogden & Fixsen 2015; Pearce, Pons & Neitzert 2018; Rafique et al. 2017). There are many implementation frameworks available in previous researches, but it is pertinent to develop a research methodology that helps in consolidating an implementation framework, in line with the requirement of competitive times. Hence, keeping this requirement in view, the purpose

of this research is to articulate the research methodology for implementation framework in lean manufacturing sector and in order to attain this, the authors have conducted a detailed literature study from the basics of tool to their utilization which further constitutes to the development of research methodology. The research milieu of this literature study starts with the discussion of the typical layers required to design the research methodology (Nesensohn, 2014; M. Saunders, Lewis & Thornhill 2009), which are research philosophies, logics, purposes, approaches, strategies and data collection techniques. This is followed by a detailed discussion regarding the selection and planning of the research methodology, eventually culminating in the organization of these research layers and tools; from where the research methodology needs to be selected.

A clear research context is one of the leading requirements in research world to achieve a robust research methodology. In order to achieve this task and to help the researchers, M. Saunders et al. (2009) and M. N. Saunders (2011) in their research study have introduced a research onion, which is considered as the bench mark to explain and design any research study (Srichuachom, 2015). Nesensohn (2014) in their research study further explained and clarifies the research onion to attain more positive pictures for the research world by dividing it into four distinctive layers. It has been summarized that a research onion consists of following layers which are research philosophies (ontology, epistemology), research logics (inductive, deductive), research purposes (exploratory, explanatory and descriptive research), research approaches (includes qualitative research, quantitative research and time horizons), research strategies (like survey, case study, phenomenology, ethnography) and lastly the research techniques (data techniques and procedures). Hence keeping these aspects in view, the authors have observed that to start the methodology development, the philosophy of pragmatism is highly suitable, followed by abductive logic, in case of technique, mixed mode research is best, whereas in strategy selection, case study strategy is the most suitable due to its multi-functional ability of in-depth operational study and the comparative qualitative and quantitative research through longitudinal and cross sectional case study respectively. Furthermore, the data collection process includes interviews, field observations and documentations through actual visits in case study. In order to design the research methodology, the remainder of article is structured as the next section is basically about the literature review of previously available researches that will be referred, afterwards methodology, then discussion and in last the conclusion of the research.

#### LITERATURE REVIEW

In literature review, the authors have observed that the current methodology that is to be planned should be inclined with the previous research studies that have utilized the pattern of implementation framework development on practical implications as mentioned in previous research studies in

Table 1. A detailed research methodology can be made that supposed to be divided into three stages that are research context and approach, framework development and implementation and framework validation.

In research context section, commonly literature review is utilized in a modern, simple, logical and comprehensive way to decide the steps for implementation framework. The framework development and implementation section emphasizes on case study for implementation framework in manufacturing sector related to lean manufacturing (Abdulmalek & Rajgopal 2007; Joseph C Chen & Chen 2014; James C Chen, Cheng, & Huang 2013). Yin (2013) clearly mentioned that the case study methodology is further subdivided into two types that are “Longitudinal case study” and “Cross-sectional case study”. Voss, Tsiriktsis, and Frohlich (2002) in their research work further explained that a “Longitudinal case study” is the type of study that constitutes on in-depth study of one single company, so, the longitudinal case study observed that the most appropriately selected methodology. This research methodology emphasis the use of longitudinal case study as involves in depth study of operations (Büyüközkan, Kayakutlu, & Karakadılar 2015) for the section of framework development & implementation.

#### METHODOLOGY

In order to achieve the task (as mentioned in Figure 1), the authors studied the most relevant high impact journals, conference papers, books and surfed the interweb without compromising on the legitimacy of the data. Majority of the data has been extracted from research papers, and authors decided to omit low quality journals. As mentioned in Table 2, as the survey progressed, the references were gathered from the bibliography of the most relevant papers and they were studied in detail as well. In order to find most relevant literature, Google Scholar search engine was used to explore the databases which include, but are not limited to, ScienceDirect, Elsevier, JSTOR, T&F, IEEE Xplore, Springer, Scopus, Inderscience, Emerald Insight Wiley, Oxford University Press etc. As mentioned in Figure 1, the literature review does not only focus the previous researchers related to the basic tool selection but also focuses on the previous implementation frameworks utilized in this regime to form a research methodology.

#### RESULTS

In line with the research objective, the authors utilized the research onion approach to choose the most apposite approaches and philosophies for methodology design. Since, Elnadi (2015) and (Nesensohn, 2014) checked spacing in their research study has followed a pattern that, after complete peeling of the research onion, it is strongly

TABLE 1. Comparison of frameworks

Frameworks	Methodology	Data Collection Methods	Overall Impression
Kumar, Antony, Singh, Tiwari, and Perry (2006)	Longitudinal case study	Case study, Field Observations	The framework is simplistic in nature and is extremely comprehensible.
Wang, Ming, Kong, Li, and Wang (2011)	Longitudinal case study (Initiated through Literature)	Case study, Field Observations	The framework is comprehensible, but highly intricate in nature.
Vinodh, Gautham, and Ramiya R (2011)	Longitudinal case study (Initiated through Literature)	Case study, Field Observations	The framework is simplistic in nature and is extremely comprehensible.
Karim and Arif-Uz-Zaman (2013)	Longitudinal case study (Initiated through Literature)	Case study, Field Observations	The framework is simplistic in nature and is extremely comprehensible.
Jasti and Kodali (2015)	Literature review	Literature review	The framework is comprehensible, but highly intricate in nature.
Olesen, Powell, Hvolby, and Fraser (2015)	Longitudinal case study (Initiated through Literature)	Case study, Field Observations	The framework employs the latest research advancements and is comprehensible, but highly intricate in nature.
Swarnakar, Vinodh, and Antony (2016)	Longitudinal case study (Initiated through Literature)	Case study through interview based survey, Field observations, expert opinions	The framework is comprehensible, but highly intricate in nature.
Jasti and Kodali (2016)	Literature review	Literature review	The framework is comprehensible, but highly intricate in nature.
Rafique et al. (2017)	Literature review	Literature review	Pivoting on literature review approach, the framework lacks practical validation.
Maqbool et al. (2019)	Literature review & Longitudinal case study	Case study, Field Observations	The developed framework is simple and comprehensible with actual practical implementation.
Cabral, Grilo, Puga-Leal, and Cruz-Machado (2011)	Literature review	Literature review	The framework is comprehensible, but highly intricate in nature.
Azfar, Khan, and Gabriel (2014)	Literature review	Literature review	The framework is comprehensible, but highly intricate in nature.
Ganzarain and Errasti (2016)	Literature review	Literature review	The framework is comprehensible, but highly intricate in nature.

recommended to select and discuss the research methods that are planned to be adopted and not only helps to get the reason of selection but also help in formation of research methodology. The selected methods are explained in Figure 2.

#### SELECTION OF BOTH "EXPLORATORY" AND "EXPLANATORY" AS A RESEARCH PURPOSE

In view of context of the research, aims and objective of this research study, the authors have characterized that the overall purpose of this study seems to carry pragmatism category of philosophy and the both "Exploratory" and "explanatory" researches are required for the formation of framework. The development and implementation of framework implementation requires explorations, but in case of implementation and validation of framework, the collection of numeric data and statistical form of data analysis is also required, which seems to be more towards "explanatory". So, both of these purposes are appropriate to utilized in this research.

#### SELECTION OF "MIXED MODE" AS A RESEARCH APPROACH

It observed that there are many reasons that can lead the authors to consider mixed mode (Both qualitative and quantitative research) as the best suite. The reasons are in order to meet the research objectives, the ideology of topic seems to be calling for further explorations and validation that will lead to mixed mode research. The topic seems to require an actual life phenomenon and in-depth study in its natural settings, however, it has controlled environment of production operations and production output. For the case of implementation framework in lean, the mixed approach is more recommendable to detect and validate the new theory that involves both leading research approaches. The research requires full understanding of implementation of lean which require richer and broader in depth data that is more possible to collect through qualitative approach, however, as mentioned above, for validation and finalization of results, the statistical formed data is required to evaluate the rich numeric data through simulation modelling based on hypothesis.

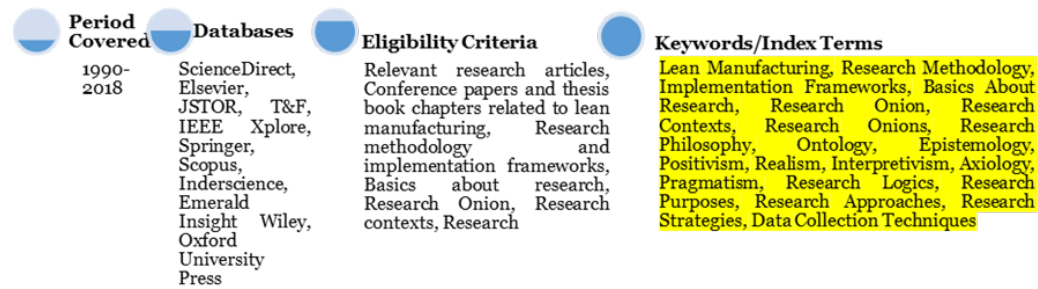


FIGURE 1. Data search criteria

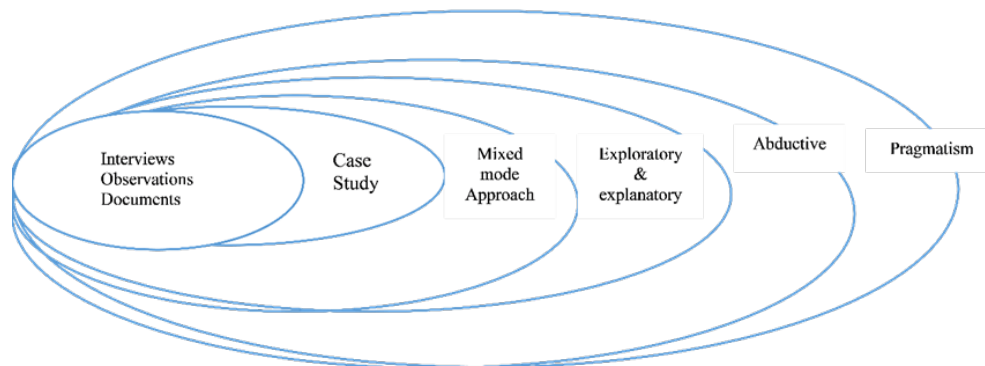


FIGURE 2. Research method selection

Based on the designed research model, the authors have concluded that the mixed method design seems to be feasible in which primary core method will be qualitative and the supplementary components that is utilized for validation will be quantitate method. For the development and implementation of framework, the data collection will be started from the qualitative case study, in which data will be collected through field observations, documents and structured interview. According to the study of the Morse (2003) and Morse (2010), for implementation frameworks, the major core or primary data will be qualitative data through case study which is utilized to increase depth and to make research more richer and useful. While, the supplementary component will be the quantitative data attained through simulation modelling which will be sequentially paced to help the authors towards completion.

#### SELECTION OF "CASE STUDY" AS A RESEARCH STRATEGY

Since, after selecting the mixed approach as a research purpose, and keeping in view the research context and aim of this study, it observed that the best suitable research strategy that will fall in the rhythm would be case study strategy. Moreover, Elnadi (2015) the Robson and McCartan (2016) have mentioned in their studies that the case studies are more elicited towards the mixed and qualitative research. The leading reasons of selection of case study as a methodology are through the literature review it is very clear that, in the previous researchers, it has been commonly observed that the case study methodology is considered to be the most feasible in order to propose and validate the implementation frameworks which are new

and unique like technology combined lean implementation framework (Rafique et al. 2017). Moreover, according to Yin (2013) in his study clearly mentioned that the case studies are feasible for the area of researches in which the previous research is very few (Elnadi, 2015). It has been observed that out of all the available strategies, only the case study carries the good ability to attain both the qualitative and quantitative data which further helps to get deepness and richness of information which is one of the leading requirement. The case study is also helpful to achieve the in-depth data and help researcher to understand the complexity, intricacy and involvedness of new processes. The case study seems feasible, as lean is something which involves implementation in operations (with or without trails) and the best strategy that can help to achieve implementation is the case study, because it carries the aptitude to scrutinize contemporary sets of events and trails. Since, the designing of framework has already been done so the next step is development through implementation that can be achieved successfully through case study (Neta et al. 2015) and considered the most suitable approach to propose. Now, there is no doubt that the selected approach is case study, so authors are strongly convinced to first select the right case study which is facing the same problem as that of research problem and willing to implement lean implementation framework in their operations to achieve improvements. Hence, keeping these valid reasons in view and as per discussion about the type of case studies previous which are longitudinal and multiple case studies, as the requirement is to develop and implement lean concept combined with any new tools, so the leading requirement of the research is the deep and detailed in depth study of operations and

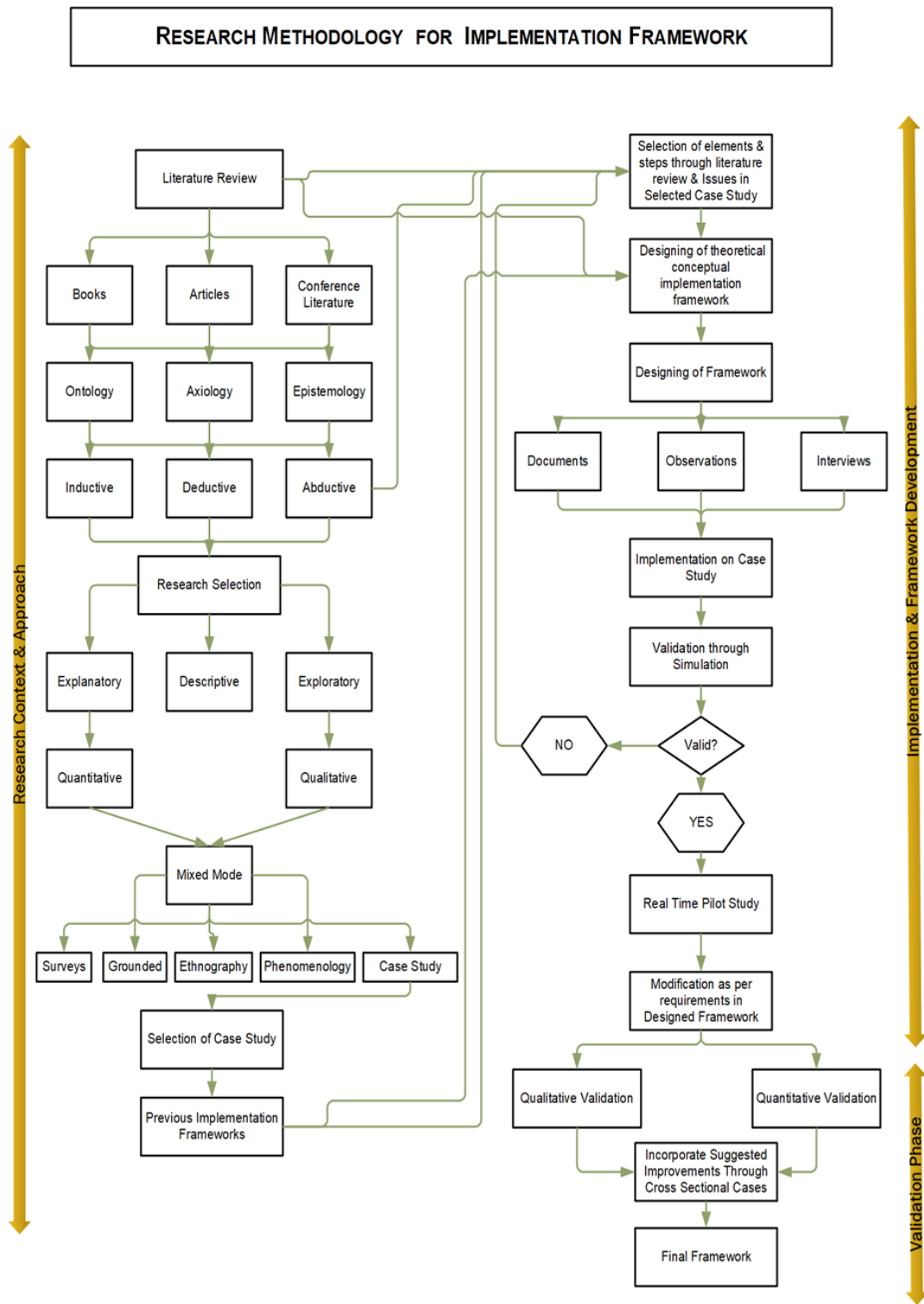


FIGURE 3. Proposed Research Methodology

authors are convinced with literature review and seconds the ideology to utilize longitudinal case study.

#### SELECTION OF DATA COLLECTION TECHNIQUES

As, the selected approach is case study, so in order to implement the conceptual framework on case study, the authors will implement the designed conceptual framework on the case study and the selected data collection techniques that will be utilized to study case study and to implement conceptual framework through interviews, documentations and observations. After the selection of research methods, in order attain clearer picture, it is feasible to first form the research model or research flow chart that will be helpful further to achieve the aims.

#### DEVELOPMENT OF RESEARCH METHODOLOGY TO ATTAIN IMPLEMENTATION FRAMEWORK

In accordance with the research objective, the authors have developed a framework that describes the research flow for developing an implementation framework. The framework is categorized into three categories, given as under:

1. Research Approach and Context
2. Framework development and implementation
3. Framework validations

The first stage of this research model or flow chart is inclusive of gaining the basic knowledge about the topic, understanding the topic, finding the gaps in the previous literature available and designing of conceptual implementation framework based on literature review. As mentioned in previous chapter, a systematic literature review has been conducted by utilizing online-computerized data bases databases like Emerald, Elsevier, Scopus, Springer, Taylor & Francis online, ISI web of science, IEEE explorer, Inderscience publishers and world scientific publishers that has provided numerous articles, related books, conference papers and a lot of well-reputed thesis. The details regarding the selection of methodology is already explained in detail in previous section in which a mixed mode methodology is selected and a case study approach will be utilized to implement the conceptual framework.

In the conceptual framework, the steps and phases selected through frameworks available in literature. This is the stage 2 of the research and can be considered as most important phase as it first involves the right selection of case study and will be studied and the conceptual implementation framework will be implemented on the case study. So, after satisfactory implementation of all phases, the final framework will be produced based on the corrections that seem to be required at the time of framework development that will be further validated in next phase.

In order to validate and to increase the generalizability of implementation in natural settings, the framework will be validated and implemented on other selected products that will be helpful to increase the rigor of the research in stage 3.

The major strength and contribution of this research methodology is the development of one concise research methodology that considered as the next generation to achieve more-leaner implementation frameworks and implicates a clear innovation towards the field of operations management. The study is highly beneficial in the understanding, management and clarification of the prominent paradigms required for development of research methodology for an implementation framework. Additionally, the consolidated nature of the study to provide all deliverables on a single platform will contribute towards the aid of academicians and practitioners working in this field.

#### CONCLUSION

With the advancement in the field of operations management, there is an onus on the researchers to develop precise and rigorous methods to propose an implementation framework that is one-fit-for-all. Through a literature review approach amalgamated with grounded theory, the authors have posited a framework that establishes a clear avenue of research methodology. It was observed that in operations management research, it is pertinent to employ the pragmatism philosophy which fits seamlessly with the abductive logic of research. Furthermore, an amalgam of qualitative and quantitative research is needed since the conceptual approach is translated to an implementation approach by its virtue. Consequently, a case study is required to implement and validate the framework. As it is further observed that the in-depth study and implementation and validation of framework in natural settings is required so the longitudinal case study is considered to be the most suitable option. Moreover, the data collection is proposed to be conducted through interviews, field observations and documentations through actual visits in case study. Subsequently, based on these selections, a detailed research methodology has been made which is divided into three stages that are research context and approach, framework development and implementation and framework validation. However, it must be kept in mind that the research is by no means exhaustive in nature and has areas for improvement; one proposition would be the integration of decision-making tools for the selection of right approach and logic. In future, the multicriteria decision making tools can be used for the selection of alternatives, that strengthen the decision.

#### DECLARATION OF COMPETING INTEREST

None.

#### REFERENCES

- Abdulmalek, F. A., & Rajgopal, J. 2007. Analyzing the benefits of lean manufacturing and value stream mapping via simulation: A process sector case study. *International Journal of Production Economics* 107(1): 223-236.

- Azfar, K. R. W., Khan, N., & Gabriel, H. F. 2014. Performance Measurement: A Conceptual Framework for Supply Chain Practices. *Procedia - Social and Behavioral Sciences* 150: 803-812. doi:10.1016/j.sbspro.2014.09.089
- Büyükoğuzkan, G., Kayakutlu, G., & Karakadılar, İ. S. 2015. Assessment of lean manufacturing effect on business performance using Bayesian Belief Networks. *Expert Systems with Applications* 42(19): 6539-6551.
- Cabral, I., Grilo, A., Puga-Leal, R., & Cruz-Machado, V. 2011, 2011/05//. *An information model in lean, agile, resilient and green supply chains*. Paper presented at the 2011 IEEE 3rd International Conference on Communication Software and Networks (ICCSN).
- Chen, J. C., & Chen, K.-M. 2014. Application of ORFPM system for lean implementation: an industrial case study. *The International Journal of Advanced Manufacturing Technology* 72(5-8): 839-852.
- Chen, J. C., Cheng, C.-H., & Huang, P. B. 2013. Supply chain management with lean production and RFID application: A case study. *Expert Systems with Applications* 40(9): 3389-3397.
- Elnadi, M. (2015). An innovative framework for implementing lean principles in product-service system.
- Ganzarain, J., & Errasti, N. 2016. Three stage maturity model in SME's toward industry 4.0. *Journal of Industrial Engineering and Management* 9(5): 1119. doi:10.3926/jiem.2073
- Hines, P., Holweg, M., & Rich, N. 2004. Learning to evolve: a review of contemporary lean thinking. *International Journal of Operations & Production Management* 24(10): 994-1011.
- Holweg, M. (2007). The genealogy of lean production. *Journal of Operations Management* 25(2): 420-437.
- Jasti, & Kodali. 2015. A critical review of lean supply chain management frameworks: proposed framework. *Production Planning & Control*(ahead-of-print) 1-18.
- Jasti, N. V. K., & Kodali, R. 2015. Lean production: literature review and trends. *International Journal of Production Research* 53(3): 867-885.
- Jasti, N. V. K., & Kodali, R. 2016. Development of a framework for lean production system: An integrative approach. *Proceedings of the Institution of Mechanical Engineers, Part B: Journal of Engineering Manufacture* 230(1): 136-156.
- Karim, A., & Arif-Uz-Zaman, K. 2013. A methodology for effective implementation of lean strategies and its performance evaluation in manufacturing organizations. *Business Process Management Journal* 19(1): 169-196.
- Kumar, M., Antony, J., Singh, R., Tiwari, M., & Perry, D. 2006. Implementing the Lean Sigma framework in an Indian SME: a case study. *Production Planning and Control* 17(4): 407-423.
- Maqbool, Y., Rafique, M. Z., Hussain, A., Ali, H., Javed, S., Amjad, M. S. Atif, M. 2019. An Implementation Framework to Attain 6R-Based Sustainable Lean Implementation—A Case Study. *IEEE Access* 7: 117561-117579. doi:10.1109/access.2019.2936056
- Martinez-Jurado, P. J., & Moyano-Fuentes, J. 2014. Lean management, Supply chain management and sustainability: a literature review. *Journal of Cleaner Production* 85: 134-150.
- Morse, J. M. 2003. Principles of mixed methods and multimethod research design. *Handbook of mixed methods in social and behavioral research*, 189-208.
- Morse, J. M. 2010. Simultaneous and sequential qualitative mixed method designs. *Qualitative Inquiry*.
- Moyano-Fuentes, J., & Sacristan-Diaz, M. 2012. Learning on lean: a review of thinking and research. *International Journal of Operations & Production Management* 32(5): 551-582.
- Nesensohn, C. 2014. *An Innovative Framework for Assessing Lean Construction Maturity*. Liverpool John Moores University.
- Neta, G., Glasgow, R. E., Carpenter, C. R., Grimshaw, J. M., Rabin, B. A., Fernandez, M. E., & Brownson, R. C. 2015. A framework for enhancing the value of research for dissemination and implementation. *American Journal of Public Health* 105(1): 49-57.
- Ogden, T., & Fixsen, D. L. 2015. Implementation science. *Zeitschrift für Psychologie*.
- Olesen, P., Powell, D., Hvolby, H.-H., & Fraser, K. 2015. Using lean principles to drive operational improvements in intermodal container facilities: A conceptual framework. *Journal of Facilities Management* 13(3): 266-281.
- Pearce, A., Pons, D., & Neitzert, T. 2018. Implementing lean—Outcomes from SME case studies. *Operations Research Perspectives* 5: 94-104.
- Rafique, M. Z., Ab Rahman, M. N., Saibani, N., & Arsad, N. 2017. A systematic review of lean implementation approaches: a proposed technology combined lean implementation framework. *Total Quality Management & Business Excellence*, 30(3-4): 386-421. doi:10.1080/14783363.2017.1308818
- Rafique, M. Z., Ab Rahman, M. N., Saibani, N., Arsad, N., & Saadat, W. 2016. RFID impacts on barriers affecting lean manufacturing. *Industrial Management & Data Systems* 116(8): 1585-1616. doi:10.1108/imds-10-2015-0427
- Robson, C., & McCartan, K. (2016). *Real world research*: John Wiley & Sons.
- Rose, A., Deros, B. M., & Rahman, M. 2014. Critical success factors for implementing lean manufacturing in Malaysian automotive industry. *Research Journal of Applied Sciences, Engineering and Technology* 8(10): 1191-1200.
- Sahwan, M. A., Ab Rahman, M. N., & Deros, B. M. 2012. Barriers to Implement Lean Manufacturing in Malaysian Automotive Industry. *Jurnal Teknologi* 59(2).
- Saunders, M., Lewis, P., & Thornhill, A. (2009). Understanding research philosophies and approaches. *Research Methods for Business Student* 4: 106-135.
- Saunders, M. N. 2011. *Research Methods for Business Students*. 5<sup>th</sup> edition. Pearson Education India.
- Srichuachom, U. 2015. *The Impact of Lean Approaches to Support Quality Developments in Thailand: An Investigation of A Claim of Universality of Lean Thinking*. University of Southampton.
- Susilawati, A., Tan, J., Bell, D., & Sarwar, M. 2015. Fuzzy logic based method to measure degree of lean activity in manufacturing industry. *Journal of Manufacturing Systems* 34: 1-11.
- Swarnakar, V., Vinodh, S., & Antony, J. 2016. Deploying Lean Six Sigma framework in an automotive component manufacturing organization. *International Journal of Lean Six Sigma* 7(3).

- Vinodh, S., Gautham, S., & Ramiya R, A. 2011. Implementing lean sigma framework in an Indian automotive valves manufacturing organisation: a case study. *Production Planning & Control* 22(7): 708-722.
- Voss, C., Tsiriktsis, N., & Frohlich, M. (2002). Case research in operations management. *International Journal of Operations & Production Management* 22(2): 195-219.
- Wahab, A. N. A., Mukhtar, M., & Sulaiman, R. 2013. A Conceptual Model of Lean Manufacturing Dimensions. *Procedia Technology* 11: 1292-1298. doi:10.1016/j.protcy.2013.12.327
- Wang, L., Ming, X., Kong, F., Li, D., & Wang, P. 2011. Focus on implementation: a framework for lean product development. *Journal of Manufacturing Technology Management* 23(1): 4-24.
- Xiu-xu, Z., & Lin-yan, N. 2009. *Study of the lean logistics operating model based on RFID and its application in auto industry*. Paper presented at the Computer Network and Multimedia Technology, 2009. CNMT 2009. International Symposium on.
- Yin, R. K. 2013. *Case Study Research: Design and Methods*: Sage Publications.