*Nanotechnology Perceptions*
*ISSN 1660-6795*
*www.nano-ntp.com*

# An Extensive Synopsis of a Literature Review on Lean Implementations

**Yogesh Ganpatrao Chaugule[1], Dr. Jayendra Anandrao Khot[2], Dr. M. M. Narke[3]**

*[1]Assistant Professor, Department of Mechanical Engineering, D.Y.Patil College of Engineering and Technology, Kasaba bawada, Kolhapur*
*[2]Prof Registrar, D. Y. Patil Agriculture and Technical University, Talsande*
*[3]Principal, Dr.D.Y.Patil Polytechnic, Kolhapur*
*Email: chauguleyogesh17@gmail.com*

The existing research articles on lean are examined to determine the degree of use of various lean techniques; implementation barriers and advantages are also taken into account. This document identifies and lists the most prevalent lean tools, obstacles, and advantages that are utilized in diverse organizations. The majority of typical barriers are also elements of the superiority of the lifecycle at work.

**Keywords:** Quality work life, Lean Manufacturing, Toyota production system, Kanban.

## 1. Introduction

Essential instrument in the current environment for all businesses is lean manufacturing. Due to globalization, industries are currently seeing increased levels of competitiveness. In this situation, businesses must utilize certain tools and strategies to improve their performance and quickly adapt to the demands of customers to stay in the market and compete. The main idea behind lean manufacturing is to ensure that the consumer does not pay an excessive amount for a high-quality product.

A try has been completed to provide a survey of the works in this paper to determine the significant and practical assistance to this Lean notion.

Numerous tackles and methods are cast off in lean engineering; the selection of tackles is contingent upon the specific needs. Numerous factors contribute to Lean's effectiveness. Businesses that have adopted lean manufacturing have increased levels of competitiveness and flexibility. On the other hand, lean manufacturing offers a setting that is very supportive of waste reduction.

## 2. Objectives:

- To determine the degree of Lean application across various industries.
- To determine which tool is most and least utilized under
- To Implement that is lean.
- To investigate the advantages and obstacles of implementing Lean engineering.
- To assess the execution of Lean engineering.

## 3. Outcomes and Discussions

The assessment process has taken into account the Lean manufacturing research articles published in a number of reputable publications. Following extensive analysis of the Lean application, with the findings of the study articles under consideration for evaluation, included in Annexure 1. Review articles that have been taken into consideration have been categorized according to knowledge of lean, lean implementation, lean barriers, lean benefits, and performance. The corpus of literature has a sizable number of studies that address the potential use of lean tools in various sectors as well as knowledge of them. We go over the one significant study of this kind under.

Roba Salem et al, [1] examined the degree of acceptance of lean ideas, methods, instruments, and approaches across several Qatari industries, to ass's lean awareness and to understand how people view the advantages and difficulties of being lean. Through the use of an online survey, information was gathered from 333 businesses across a diversity of industries, counting the oil and gas, theoretical, and facility segments. The findings indicated that in order to strategically improve present efficiency and contend with global competitiveness, Qatari companies need to give lean thinking more credit. Additionally, research shows that different industrial sectors have varying degrees of understanding, recognition, and enjoyment of lean ideas.

Chaple[2] looks into the factors that help and hinder the use of lean ideas and their diffusion in the industrial sectors of India. The outcome demonstrates how lean assessment is currently the main area of study for lean manufacturing. Leanness draws attention to particular issues posed by various managers in charge of lean applications, allowing them to evaluate the degree of lean application and defend expenditure above and beyond lean application. He developed multiple criteria decision-making (MCDM) for lean evaluation to evaluate lean presentation comprehensively and the acceptance of lean in India; nevertheless, success is still at the beginning of the trip. There are more industries in India with medium to low diffusion of lean, including the car and electronics sectors.

The study conducted by Pratik Chikhalikar[3] concentrated on the use of lean in the Indian train engineering element. Studies revealed the crucial lean instruments and a timeline for putting them into practice. A study found that the following variables have an impact on the application of lean: Seven categories of garbage Absence of information exchange, inappropriate handling of inventories, bottleneck functioning, Issues with material flow and

transportation Single Minute Exchange of Die, Six Sigma, 5S, JIT, Kanban, Kaizen, TPM, and Six Sigma

A research by Rakesh and Vikas Kumar [4] determined the importance of Lean Manufacturing components about Indian In the industrial sector, the research also lists the advantages attained, the main challenges encountered, and the negative effects, which include excessive cost-cutting, abnormally low inventories, excessive reliance on Lean principles, the health of individuals and society at large, and the quality of the products.

In order to increase the efficiency of India's furniture manufacturing sector, Sudipta Chowdhury [6] carried out a study. Different lean Short interval control, Gemba (The Real Place), and Single-Minute Exchange of Dies (SMED) were among the tactics used. The outcome showed a considerable gain in terms of money as well as a decrease in the processing times for various lots. The study also shows that a developed multifactor output of 2.26 was associated with an improvement in overall equipment effectiveness. This study demonstrated that lean techniques might be successfully functional in the furniture manufacturing sector.

According to research by Youssef Larteb et al. [7], top organization promise, participation, and distribution of resources remain critical success factors aimed at lean adoption. time and funds for development initiatives, capable organization guidance, and a staff improvement program. The seven lean implementation parameters—personalized approach, top organization assurance, resource distribution, solid communication, structural method, multifunctional teams, and continuous enactment size—were included in the study's structure questionnaires.

Neha Verma. [10] carried out a revision to pinpoint waste-related issues, such as the reason for equipment malfunctions and bottlenecks, and address them in the use of lean engineering in small-scale businesses. The process was inspected with regard to inventory control, waiting times, set times, and getting rid of non-value-added time and actions. In order to improve the product's flow through the production process, methods and layouts were modified rather than additional machinery was bought or workers being asked to work longer or harder.

According to a study by Nordin Norani [11], the primary cause of the letdown of Lean engineering deployment is the let-down in controlling the organizational change management and the lean engineering alteration process. function as the foundation for additional empirical study and verification. Give practitioners clear direction, deeper comprehension of the lean change, and/or tools to reduce confrontation and disputes while adopting a lean manufacturing system. Eleven crucial factors were examined in this study, and a framework for organizational change was developed to help practitioners better understand the lean transition and reduce obstacles and conflicts that could hinder the implementation of lean, increasing the likelihood of success.

Research was done in [12]by Azharul Karim et al. to create an efficient approach for putting lean manufacturing strategies and a leanness, The present study has employed the following technique. They include Performance factors, Lean team research, and production and process information. Together, VSM and MTM provided a novel method based on the Lean concept and standardized procedures for reducing lead times and measuring production.

A study by George L. Hodge [14] sought to determine which lean tools the textile industry in the US may use to cut waste and non-value-added operations. increase client satisfaction, The author noted the following obstacles to implementing lean manufacturing: management and

shop floor staff are resistant to change, and employees are hesitant to suggest changes. miscommunication between sales, marketing, product, and development; multilingual training is required because shop floor staff do not speak English as their first language.

According to a [15] research by Richard Lee Storch et al., building methods must be developed as lean ship production necessitates constant and continuous process flows. and adhered to, even at the price of design ease (design for production), which represents the appropriate job breakdown, particularly block breakdown. It entails integrating and balancing the painting, outfitting, and hull jobs; facilitating smooth, continuous workflows across production levels; and making the most of group technological benefits. Three metrics—work- in-process (WIP) account level, levelling issue index, and amount—are suggested to track lean process flows in shipbuilding.

Marodin, Giuliano Almeida, and others [16]. According to the study, the following seven factors influence the Manufacturing Cell (MC)'s usage of LP practices: (i) The reasons for adopting LP include (i) the company's prior experience with LP; (ii) the necessity for supporting areas to be involved in some LP performs; (iv) the interdependence of certain performs; (v) the range of product copies formed by the MC; (vi) the interaction among LP and MC qualities; and (vii) the size of the apparatus used in the MC. The following are qualifying qualities for LP in MC: 1. Teamwork and leadership (TWL), 2. Constant Improvement (CI), 3. MCT: Cross-training and multiple functioning. 4. The liberty of WAU-Workers.5. Standardized work (STW), 6. Housekeeping at WHK Workplace, 7. PULLPull manufacturing,

8. Curved manufacture with SPR 9. Quick Setup Technology (QST) 10.TPM 11. Lean Presentation Measures, or LME 12. VPC: Visual management control over production, 13. Visual production control (VQC) management. 14. EQA: Autonomy of Equipment, 15. A one-to-one flow, 16.VIS Visibility and communication of information. 17. Size and form of the LSS-Layout. 18. ODF: Dominant flow organization.

Rymaszewska Anna Dorota [17] this study resolves to determine the obstacles to lean engineering application in small and medium businesses (SMEs). The possible obstacles to lean adoption are delineated through a comparative analysis of the various industrial environments and organizational attributes. Getting more done with less. draws comparisons between the furniture and boat sectors. takes into account internal processes as well, such as QA, visual control, workload balancing, standardization, material replenishment, and reliable technology. The research identified Hijunka and JIT as internal implementation facilitating/reinforcing variables, and attitude, know-how, operative relationships, communication, funding, value creation, and administrative knowledge as influential factors.

1. The difficulty of long-term direction; 2. The difficulty of transforming into a education association; and 3. The difficulty of smoothing off, he continues. procedure. 4. JIT and supplier-buyer interactions. 5. Work procedural standardization and employee empowerment. Further empirical evidence can strengthen the results' validity.

Vinodh [18]., The aim of this training is to inspect lean manufacturing techniques across several sectors and pinpoint the essential elements needed to successfully use them. An Equitable Structure Both the measurement and the structural models are constructed using

modelling techniques. Statistical approximations are then employed to verify the constructed model. Four enablers—administration accountability leanness, engineering administration leanness, engineering policy leanness, and knowledge and staff leanness—were the basis of a questionnaire created for data collecting. The R2 value was also computed in this study, and it shows that lean manufacturing, lean manufacturing strategy, lean workforce, and lean management responsibilities all have a significant impact on organizational performance.

Ultimately, fully dedicated management, exceptionally skilled, driven, and empowered staff members operating as a cohesive one. Integration of activities internally with vendors and clients. encouragement of inventive culture and innovation. The key component of implementing lean is eliminating waste and streamlining operations.

The study by Dave [19] addresses information and communication systems in conjunction with lean construction. Research indicates that by using strategies like With the use of development modelling, lean concepts, and method examination methods, the engineering sector keeps its processes operating efficiently.- Industry-wide process standardization will be extremely productive and efficient.

Although the application of lean manufacturing might enhance organizational performance, Rakesh [4] study found that the majority of Indian enterprises now employ this idea as a tool for progress rather than assimilating it as a way of life. Performance may be significantly improved if company culture is given full attention. The main ramifications are as follows: (1) One piece or single-piece flow method replaces batch production; (2) Development is complete at a single idea since which substantial is dragged through the charge watercourse and the rate of flow is contingent on client request; and (3) Here is less substantial in to come for dispensation between effort places; Consequently, inventory of work-in-process (WIP) is decreased, and since examination is now a crucial component of manufacturing processes, the product is not Depending on line inspector clearance for quality, manufacturing's reference has shifted from supply and production to consumer demand. In Indian companies, there is a need for improvement in top management policies and attitudes towards lean implementation. Specifically, top management concerns are crucial for successful lean implementation. According to research, seven main factors are linked to LPI barriers: management, resources, knowledge, conflicts, employee morale, finances, and prior experience. With a rating of 3.9 out of 5, top management is regarded as higher than others. Additionally, it is suggested that

the senior leadership team be made aware of the need to foster a culture of learning inside the company and to build good communication to coordinate change.

Giuliano Almeida Marodin [21]carried out a study to categorize the hazards influencing the process of implementing lean production and to show how the categorization may be used to determine the connections between the hazards. For the current study, the researcher analyzed documents, conducted interviews, and made observations, among other kinds of information. Three categories were used in this study to classify hazards that impact LPI: shop floor engagement, top and middle management support, and administration of the LPI process. The main focus was on the categorization and correlation between the hazards. After 14 hazards were found, the data was gathered and examined using an exploratory factor analysis (EFA). It's important to note this study's shortcomings. First, only internal hazards were included in

the LPI; no external risks were included. Secondly, It ignores the reaction and monitoring phases of risk management.

According to a [22] research by Rahul Sindhwani, LI would strengthen ties between manufacturers and customers by satisfying their most recent demands. Normal Seven factors are used: overproduction, transport, waiting/delays, record waste, gesture excess, defects, and processing waste/over-processing. The following equipment and methods for getting rid of garbage were: Kanban/pull system, VSM, 5s, Applying pull systems, value streaming, and one-piece flow—all lean and agile concepts—boosted the bottom frame's production rate. The pull system is used to recognize when higher production rates are required. To determine the limitations and make a single piece of flow in instruction to meet the essential cycle time, VSM was used.

The [23] study by Ramune Ciarniene et al. highlights the difficulties and obstacles that must be dealt with in order to use the lean approach. Lean business Simply said, "Lean" refers to a methodology that views any use of resources for any purpose other than producing value for the final consumer as waste that should be eliminated. Three categories of impediments have been identified by research: issues related to people, processes, and sustainability. The study recommended using the tools and approaches first rather than giving personally relevant concerns more thought. The true barriers are issues with commitment, personal drive, and trust. Second, as acknowledged by upper management and appropriately maintained, Thirdly, the company's strategy needs to take LI into account. Concluding remarks: pull-driven systems, continuous flow, VSM waste removal, particular value to the client, and CI.

According to studies by Eida Nadirah Roslin [24], these organizations are unable to fully investigate and capitalize on the efficacy of the system because to the LM approach. Moreover, they do not see any significant advances when compared to L M success requirements. Pick-and-choose approaches were employed for a considerable amount of time. The obstacles of LMI were grouped into three categories, plant ground workers' and central organization's attitudes, the incapacity to count advantages, and the absence of commitment from top and senior supervision. The theoretical model of a fully developed LMS application takes organizational performance, lean manufacturing, and influence elements into account. Here are some implementation challenges, perceived obstacles, workplace culture, financial constraints, and knowledge and its comprehension on all levels.

Patel Nirav [25] LM is a viable business approach that is a successful management philosophy for enhancing the company via streamlining process operations and getting rid of non-value-added waste. When material processing stages are combined with information flow and other pertinent data, VSM may be a very potent instrument. Price, Substantial Price, Duration (min), and Predecessors, together with their link to both money and time, were the parameters that were employed. The techniques used were the value-adding period outline, quality filter, production variety funnel, request strengthening charting, procedure action plotting, and associated factors. VSM operates in a wide range of industries, including hospitality, manufacturing, services, automotive, casting and machining, and transportation.

The aim of this study, according to Shams Rahman [26], is to determine how much LM performs are used by Thai engineering corporations. and their effect on the operational effectiveness of businesses. Four metrics—fast distribution associated to rivals, product unit

cost compared to participants, general output, and client gratification—are used to assess operational effectiveness. The findings show that three concepts—JIT, waste removal, and flow management—play a crucial part. Thirteen out of twenty-one procedures were classified as lean practices, including (1) cutting the size of the manufacturing lot; (2) cutting the setup time; (3) concentrating on a single dealer; and (4) putting preventative maintenance in place

doings, (5) cycle time discount, (6) list reduction to reveal engineering, delivery, and preparation issues, (7) utilizing new procedure gear or skills, (8) utilizing quick switch techniques, (2009) continuous/one piece flow, 10) utilizing pull-based production scheme/Kanban, 11) eliminating blocks, 12% utilizing error proofing methods/Pocomoke, and

(13) eliminating waste. The impact of LP on active presentation was examined for both the size and ownership categories of enterprises using multiple regression models. To gratify equally internal and external consumers, businesses seem to be keeping a greater degree of completed product and material supply and are not entirely transitioning to lean operations.

The research conducted by Kashif Mahmood [27] attempts to improve knowledge of the LP technique in order to optimize maximizing consumer value while reducing production-process waste. Productivity is the connection (sometimes expressed as a ratio or index) between the amounts of input (resources) that an organizational system uses to create its output (goods and/or services) and the product itself. Typically, efforts are separated into four categories: labour, money, materials, and vigour. The following factors indicate successful lean initiatives: quality, cost, flexibility, delivery time, and reliability. Other elements that contribute to improving the welfare, influence, and motivation of the workforce and make lean more successful. Examples: Less stress, more proficiency, enhanced collaboration, decreased annoyance, enhanced customer communication, wider and increased job security, better job development, and increased workplace safety. Employees need to be prepared to alter not just the manufacturing lines but the entire company. This transformation will impact the departments of sales, logistics, marketing, and product development; if some of them does not track, Lean will not continue.

Herzog , Natasa Vujica [28] The findings indicate that the established factors may be crucial for comprehending "lean" and determining the extent of implementing lean within the framework of current production systems. Three phases make up the research. 1. The key components of LM manufacture were identified by a review of the body of literature currently in existence; 2. A survey was created, pre-tested on specialists, and piloted. It had 59 items, all of which were Likert scales with replies reaching from "strongly disagree" to "strongly agree."

3. Reliability and validity assessments were performed on the collected data before analysis. Usually, three distinct validity kinds are measured: Construct validity, content validity, and validity linked to criteria. Four variables link JIT to lean: the presence of on timely delivery, supplier collaboration, fewer parts needed, and hygienic conditions within the facility. The last two factors are teamwork and employee collaboration.

The research by Gulshan Chauhan [30] describes JIT, CI, and waste elimination. Vertical information drives the parameters in the direction of LM. system, pull, JIT delivery, decentralization, multifunctional teams, zero defects, continuous improvement, and waste

elimination. JIT comes first, followed by CI. He determines the significance of implementation using the SPSS correlation approach.

The [31] study by Naga Vamsi Kishna Jasti et al. finds the lean product development framework that is currently in use and helpful for implementing LMS. Using a questionnaire survey, the researcher conducted an investigation of validity and reliability. Top and intermediate level management respondents are identified by Cronbach's alpha value. There are two main categories into which the LPD framework falls: 1. investigator/academic-based; and 2. advisors/experts-based. Forty elements from eight different frameworks were found in the study, indicating that these are crucial to the application of LPD frameworks.

With the use of VSM, study by Mohammad Said Obeidat [32] detects and analyzes five different forms of waste in the sewing line: flaws, stock, excess manufacturing, shipping, and waiting periods. Quality at the source, layout redesign, and line balance are examples of applied lean manufacturing approaches. Analysis is done on the effects of using lean practices on output, and a better value stream map for the future is created. The results indicate a 43% decrease in lead time together with a 96% reduction in manufacturing wastes. Here, processing costs need to be measured and process metrics need to be specified. Product cycle time and the number of line workers determine line productivity. To raise employees' productivity, compute Work efficiency, work station target, and line target shall be completed independently. use the hourly cost calculators here. Every line will have the line balance principle tested, and the plan will be redesigned. LP without significant expenditures in technology, machining, or personnel drill.

The [33] research by Wagner, Cezar, Lucato, et al. examines the Lean operation presentation, taking into account 51 enterprises of varying sizes, from multiple sectors sections, both domestic and foreign, using two ideas: a company's DOL and the degree of leanness (DOL) of a J4000 component, In an effort to determine the link between the DOL and company ownership, size, and corresponding industry sector, three further hypotheses were investigated. Talk briefly on the advantages and restrictions of LI. The following elements are studied: product and process flow, supplier/organization/customer chain, people, information, and management/trust. Further study comparing the DOL measurement utilized here with existing, comparable LI measurements is necessary to confirm the validity of the measurement.

According to a study by David D. Ciemnoczolowski [34], milk run (MR) structures in LM describe route-based, recurring substantial control schemes that are utilized extensively to facilitate the regular and reliable delivery of containerized components to various line-side deposit locations on the plant base from an essential storing facility (referred to as the "supermarket") on an as-needed basis. Using a simulation approach, Kanban was used in this instance to address bottleneck stages. Adding extra tuggers to the route is an alternate, practical option if a single tugger is unable to fulfil demand on that specific route. identical path, which culminates in the pursuit approach. Further investigation of the tuggers operating on the same route and their dynamic interplay and effect on WS hunger seems like a viable direction.

Sourabh Sharma's [35] primary objective was to examine the possible advantages and drawbacks of lean standards, certification, and analysis, and to determine whether the Before beginning the survey, the company should first find out from lean practitioners what they think standardization would do to assist avoid key implementation issues with lean tools and

concepts. Standardization may or may not be beneficial in applying lean principles. They may measure the different goals and motivations of distinct industries and lean professionals through surveys. implementation: Employee resistance, middle management reluctance, and a lack of implementation expertise. Survey dissemination sources include corporations, lean organizations, online resources, and other sources (journals of the industry, writers, scholars, and personal connections). Directors make up 8%, employees 24%, senior managers 11%, and group managers 50%.It is harder to introduce lean standards; participants from businesses with less expertise with lean methodology support standardization more than those from more seasoned businesses do. Less agreement exists on the advantages of Lean certifications for individuals.

The research conducted by Pius Achanga [36] determined the essential elements of a successful LM deployment in manufacturing SMEs. Solid administration and organization penetrate a vision and strategy for creating while enabling a elastic administrative organization. These elements include, among other things, organizational culture, skills, and knowledge, finance, and leadership and management. The ultimate goal of good leadership is to develop the knowledge and skills of its staff.

It is evident from the literature that various lean tools, such as standardizing work/cycle decrease, and kanban, The most widely utilized lean tools in various industries include continuous flat flow/cell plan, value stream mapping, TPM/TPS, JIT, Kaizen, SMED-Single Minute Exchange Die, poke yoke, and visual administration/manager. The frequency with which the company uses the various lean tools is seen in Table 1.1.

Table 1.1 Lean Tools Considered by Researchers

| **Tools** | **Number of research papers.** | **Tools** | **Number of research papers.** |
|---|---|---|---|
| Standardizing Work/ cycle reduction | 23 | Cellular Manufacturing | 7 |
| Kanban | 22 | Cycle reduction | 7 |
| Continuous smooth flow/Cell design | 19 | Heijunka-Lead scheduling/ Re Engineering Production Process | 7 |
| Value stream mapping | 17 | One Piece flow | 6 |
| TPM/TPS | 16 | FMS/PDCA | 6 |
| JIT | 16 | Batch size/Volume Reduction | 5 |
| 5 S | 16 | Empowerment | 4 |
| Kaizen | 16 | Safety improvement program | 4 |
| SMED-Single Minute Exchange Die | 14 | Layout Improvement | 4 |
| Poke yoke | 12 | Takt time | 3 |
| Visual Management/Control | 12 | Cross training | 2 |
| TQM/ SQC/ Gemba/ QMS | 12 | | |

Drawing from extant literature, it is evident that the primary benefits of using lean methodology are waste decrease, inventory decrease, increased output, cost-related benefits, and overall effectiveness across several industries. The frequency of lean implementation advantages as reported by the various studies is shown in Table 1.2.

Table 1.2 Lean implementation Benefits.

| Benefits | Number of research papers. | Benefits | Number of research papers. |
|---|---|---|---|
| Reduction of Waste | 24 | Improved flexibility | 5 |
| Inventory reduction | 19 | Travel distance ( Material movement) | 3 |
| Productivity | 13 | Lead time | 3 |
| Costs related parameter | 11 | Profit maximize | 3 |
| Effectiveness | 11 | Set Up time reduction | 2 |
| Improved Quality | 10 | Improved Cash Flow | 2 |
| Cycle time | 9 | Safety of working conditions | 1 |
| W I P | 6 | Internal Promotion | 1 |
| Floor space | 5 | Efficiency | 1 |

According to the research that is currently accessible, there are a number of obstacles to the adoption of lean methods, including challenges with culture, lack of training, employee and management participation, and communication. The frequency of various implementation hurdles for lean found by the researchers is displayed in Table 1.3.

Table 1.3 Barriers for Lean Implementation

| Barriers | Number of research papers. | Barriers | Number of research papers. |
|---|---|---|---|
| Management involvement | 22 | Past Experience | 7 |
| Employee involvement | 20 | Resources utility | 4 |
| Communication | 14 | Knowledge | 4 |
| Lack of training | 12 | Budgets | 4 |
| Culture issue | 10 | Scared of failure | 4 |
| Lack of Know how | 10 | Conflicts | 2 |
| Financial | 7 | Improper Utilization of potential capacity of workers | 2 |

## 4. CONCLUSION

No matter the size of the business, lean principles are relevant to all of them. A great deal of work has been done in the industrial sector in distinct functional domains, the size of the sectors, and the degree of implementation vary. The study paper clearly shows that TPS, continuous flow, and kanban are the three lean tools that are most frequently utilized in the company. Three of the most frequently mentioned benefits of lean implementation are increased productivity, decreased inventory, and less waste. Other than these, the most often mentioned obstacles in the adopted organization are related to employee participation management. Since these factors also affect the excellence of effort life, it follows that research on QWL is necessary throughout the lean-implemented businesses to shed further light on the matter and demonstrate how the QWL scopes and the lean application are related.

## References

[1.] Salem, R., Musharavati, F., Hamouda, A. M., & Al-Khalifa, K. N. (2015). An empirical study on lean awareness and potential for lean implementations in Qatar industries. The International Journal of Advanced Manufacturing Technology, 1-19.

[2.] Chaple, A. P., Narkhede, B. E., & Akarte, M. M. Status of implementation of Lean manufacturing principles in the context of Indian industry: A Literature Review.

[3.] Chikhalikar, P., & Sharma, S. (2015). IMPLEMENTATION OF LEAN MANUFACTURING IN AN ENGINE MANUFACTURING UNIT—A REVIEW.

International Journal of Mechanical Engineering and Robotics Research, 4(1), 404.

[4.] Kumar, R., & Kumar, V. (2015). Lean manufacturing in Indian context: A survey. Management Science Letters, 5(4), 321-330.

[5.] Rendesi, I., Kovács, Z., Szegedi, Z., & Vastag, G. Lean Implementations in Hungary.

[6.] Chowdhury, S., Haque, K. A., & Sumon, M. Implementation of Lean Strategies in a Furniture Manufacturing Factory. IOSR Journal of Mechanical and Civil Engineering (IOSR- JMCE) e-ISSN: 2278- 1684,p-ISSN: 2320-334X, Volume 12, Issue 1 Ver. III (Jan- Feb. 2015),

PP 45-50

[7.] Larteb, Y., Haddout, A., & Benhadou, M. SUCCESSFUL LEAN IMPLEMENTATION: THE SYSTEMATIC AND SIMULTANEOUS CONSIDERATION OF SOFT AND HARD

LEAN PRACTICES. International Journal of Engineering Research and General Science Volume 3, Issue 2, March-April, 2015

[8.] Jadhav, J. R., Mantha, S. S., & Rane, S. B. (2014). Roadmap for Lean implementation in Indian automotive component manufacturing industry: comparative study of UNIDO Model and ISM Model. Journal of Industrial Engineering International, 11(2), 179-198.

[9.] Guleria, A., Thakur, T., & Belokar, R. M. APPLICATION OF VSM IN HAIR DRYER

MANUFACTURING INDUSTRY: A CASE STUDY. International Journal of Advanced Technology in Engineering and Science www.ijates.com, Volume No.02, Special Issue No. 01, September 2014 ISSN (online): 2348 – 7550

[10.] Verma, N., & Sharma, V. Lean Modelling– A Case Study for the Indian SME., (IJTRE) Volume 2, Issue 7, March-2015 ISSN: 2347- 4718.

[11.] Nordin, N., Deros, B. M., Wahab, D. A., & Rahman, M. N. A. (2012). A framework for organisational change management in lean manufacturing implementation. International Journal of Services and Operations Management,12(1), 101-117.

[12.] 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.

[13.] Panwar, A., Nepal, B. P., Jain, R., & Rathore, A. P. S. (2015). On the adoption of lean manufacturing principles in process industries. Production Planning & Control, 26(7), 564- 587.

[14.] Hodge, G. L., Goforth Ross, K., Joines, J. A., & Thoney, K. (2011). Adapting lean manufacturing principles to the textile industry. Production Planning & Control, 22(3), 237- 247.

[15.] Storch, R. L. (1999). Improving flow to achieve lean manufacturing in shipbuilding. Production Planning & Control, 10(2), 127-137.

[16.] Marodin, G. A., Saurin, T. A., Tortorella, G. L., & Denicol, J. (2015). How context factors influence lean production practices in manufacturing cells. The International Journal of Advanced Manufacturing Technology, 1-11.

[17.] Dorota Rymaszewska, A. (2014). The challenges of lean manufacturing implementation in SMEs. Benchmarking: An International Journal, 21(6), 987-1002.

[18.] Vinodh, S., & Joy, D. (2012). Structural equation modelling of lean manufacturing practices. International Journal of Production Research, 50(6), 1598-1607.

[19.] Dave, B., & Appleby, C. (2015). Striving for Continuous Process Improvement-A Construction Case Study. In Proceedings of the Indian Lean Construction Conference (ILCC 2015). Institute

for Lean Construction Excellence.
[20.] Kumar, R., & Kumar, V. (2014). Barriers in implementation of lean manufacturing system in Indian industry: A survey. International Journal of Latest Trends in Engineering and Technology, 4(2), 243-251.
[21.] Marodin, G. A., & Saurin, T. A. (2015). Classification and relationships between risks that affect lean production implementation: a study in Southern Brazil. Journal of Manufacturing Technology Management, 26(1), 57-79.
[22.] Sindhwani, R., & Malhotra, V. (2015). Lean and Agile Manufacturing System Barriers. International Journal, 3(1), 110- 112.
[23.] Čiarnienė, R., & Vienažindienė, M. (2014). How to facilitate implementation of lean concept?. Mediterranean Journal of Social Sciences, 5(13), 177.
[24.] Roslin, E. N., Shahadat, S. A. M., Dawal, S. Z. M., & Mirmohammadsadeghi, S. (2014). A Conceptual Model for Full-Blown Implementation of Lean Manufacturing System in Malaysian Automotive Industry. In Proceedings of the 2014 International Conference on
Industrial Engineering and Operations Management, Bali, Indonesia. http://iieom. org/ieom2014/pdfs/292. pdf (Accessed June 2 2014).
[25.] Patel, N., Chauhan, N., & Trivedi, M. P. (2015). Benefits of Value Stream Mapping as A Lean Tool Implementation Manufacturing Industries: A Review. International Journal for Innovative Research in Science and Technology, 1(8), 53-57.
[26.] Rahman, S., Laosirihongthong, T., & Sohal, A. S. (2010). Impact of lean strategy on operational performance: a study of Thai manufacturing companies.Journal of manufacturing technology management, 21(7), 839-852.
[27.] Mahmood, K. Productivity Improvement by Implementing Lean Production Approach. [28.] Herzog, N. V., & Tonchia, S. (2014). An Instrument for Measuring the Degree of Lean Implementation in Manufacturing. Strojniški vestnik-Journal of Mechanical Engineering, 60(12), 797-803.
[29.] Manzouri, M., Ab-Rahman, M. N., Zain, C. R. C. M., & Jamsari, E. A. (2014). Increasing Production and Eliminating Waste through Lean Tools and Techniques for Halal Food Companies. Sustainability, 6(12), 9179- 9204.
[30.] Chauhan, G., & Singh, T. P. (2012). Measuring parameters of lean manufacturing realization. Measuring Business Excellence, 16(3), 57-71.
[31.] Vamsi Kishna Jasti, N., & Kodali, R. (2014). Validity and reliability of lean product development frameworks in Indian manufacturing industry. Measuring Business Excellence, 18(4), 27-53.
[32.] Obeidat, M. S., Al-Aomar, R., & Pei, Z. J. (2014). Lean Manufacturing Implementation in the Sewing Industry. Journal of Enterprise Transformation,4(2), 151-171.
[33.] Cezar Lucato, W., Araujo Calarge, F., Loureiro Junior, M., & Damasceno Calado, R. (2014). Performance evaluation of lean manufacturing implementation in Brazil. International Journal of Productivity and Performance Management, 63(5), 529- 549.
[34.] Ciemnoczolowski, D. D., & Bozer, Y. A. (2013). Performance evaluation of smallbatch container delivery systems used in lean manufacturing–Part 2: number of Kanban and workstation starvation. International Journal of Production Research, 51(2), 568-581.
[35.] Sharma, S. Standardization and Certification in Lean Manufacturing for Technology and Product Development in Service Oriented Industries.
[36.] Achanga, P., Shehab, E., Roy, R., & Nelder, G. (2006). Critical success factors for lean implementation within SMEs. Journal of Manufacturing Technology Management, 17(4), 460-471.