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Chapter

# Lean and Kaizen: The Past and the Future of the Methodologies

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## Abstract

Lean and Kaizen improvement methodologies have been in the entrepreneurship spotlight for a long time. They can be adopted by any kind of enterprise, and they succeed in producing better long-term results, improving their performance, but most important, influencing the philosophy of the organizations implemented. In this research, many case studies and success stories of companies implementing Kaizen or/and Lean methodologies, or even the new Lean Kaizen methodology, will be introduced. We attempt to evaluate the performance of Lean and Kaizen implemented companies and distinguish the elements that made the difference. Maybe, it is some specific tool, or an aspect in the culture that was enhanced, since the implementation of these business process improvement methodologies. Finally, thoughts and estimations will be presented, regarding the future of these methodologies, in the unstable and rapidly changing economic environment.

**Keywords:** Lean, Kaizen, Lean Kaizen, performance, process improvement

## 1. Introduction

This chapter presents the methodologies of Lean and Kaizen, their contribution in the enterprises' field and their future potential contribution to the field of management.

### 1.1 Lean (production, manufacturing or management)

First of all, lean manufacturing, will be referred, as it seems to be a methodology, that was keenly embraced and wields a great acceptance in the management (theoretical and practical) world. It started with the efforts of Toyota automobile company, while some believe that Ford motor company, was also a great influence in creating its concept.

Its main scope and its achievement is the elimination of waste and this can lead in an increase in productivity.

There are many proven cases of continuous improvement with the implementation of lean thinking methods and tools. However, it is not a concept that impose specific rules or tools to be implemented, but rather it is a philosophy that encourages efforts in order to achieve its main goal, which is to eliminate waste.

### 1.2 Kaizen

Kaizen is more of a philosophy than specific technique or methodology, yet it has also affected and changed seriously the minds of the managers. It utilizes

many analytical techniques to succeed in its mission, as value-stream mapping and the5 why's.

It has been introduced that these two methodologies have provided valuable assets in the field of management. It is notable that in the last years, Lean is also referred as Lean Management, representing the value that the methodology has produced in the management field. Moreover, and even though these two above methodologies, were introduced in the manufacturing field, they have managed to expand in all business industries and it seems that have achieved much in improving organizational performance. They are highly appreciated in the theoretical and practical field of management. They are considered (many times along with Six Sigma), as business process improvement methodologies, since they aim at improving all the processes in an organization. They perform activities in order to gather data, to track and evaluate all the functioning processes, and of course, they apply a continuous improvement effort.

However, in the last years, many other aspects have emerged in the economic status, like the constant economic uncertainty, which seems to be critical and threatens even the existence of many companies. Hence, the answer to be answered is if and with which manner could these methodologies keep up their efforts and produce sustainable solutions for the enterprises.

To answer these questions many writings from experts in the field were looked into the literature and their views were registered. In the conclusion, the future aspects of these methodologies will also be presented.

## 2. Introduction to Kaizen and Lean

### 2.1 Lean

Lean is called by many names as lean manufacturing, lean production, or lean thinking. New terms are the lean management and lean industry.

The main focus of the Lean methodology, is to eliminate waste in order to obtain more resources dedicated in finding ways to satisfy the customers. It intends to intervene to the value stream of the organization, in order to improve or eliminate every unneeded process that waste resources. It is also said that lean production was founded on the idea of Kaizen.

It has a great history and it is always linked to automotive industry. Many ideas that form the lean philosophy, were created by car companies like Ford and Toyota. Sometimes lean thinking is referred as a synonymous to Toyota or Toyota production system.

Author [1] has presented the Toyota Production System, which has been defined as a method which focuses on defining and eliminating non-value added activities or waste in all systems and processes [2]. One of its approaches was the Just-in-time (JIT) methodology, which acquired the necessary resources when they were exactly needed and helped in solving many material flow problems.

Authors [3], in their book 'Lean thinking: Banish waste and create wealth in your corporation', that introduced lean to a broader audience, have managed to extend the concept in a general perspective. The same authors, define lean as: "a way to specify value, line up value creating actions in the best sequence, conduct these activities without interruption whenever someone requests them, and perform them more and more effectively".

Lean is a multi-faceted concept which was identified and coined to explain the success of the "Japanese Way of Working" that enhanced their increased competitiveness at the time [4].

Components of the "Lean Idea" include:

- operations concepts, such as zero inventories [5], Just-in-Time (JIT) [6] and small lot sizes [7];
- the underpinning of robust quality procedures exemplified by Total Quality Management (TQM) and Total Productive Maintenance (TPM); and,
- a method of working that encourages empowered employee participation which challenges the over-bureaucratic top-down, function orientated organizational structures that had traditionally dominated many "Western" organizations [8].

This view of Lean was endorsed [9], categorizing the components of Lean into four "bundles":

- JIT bundle
- TQM bundle
- TPM bundle and
- Human Resource Management (HRM) bundle.

To be successful in implementing all these Lean facets in a coordinated, coherent manner, strong leadership and a clear alignment with organizational strategy over many years is required.

The 4P's model of lean are:

In the book of [10], the 14 principles for continuous improvement are categorized in four pillars (P's):

- Philosophy
- Process
- People
- Problem solving.

The above framework is created and implemented in Toyota company.

*2.1.1 Customer value*

Lean emphasizes in the provision of value to the customer and there are three types of value:

- Values added: contribute directly to the needs of customer.
- Non-value add: no contribution to the needs of customer.
- Non-value add: (but necessary or essential non-value add)

### 2.1.2 The eight wastes

According to lean philosophy, the non-needed (not-adding value) activities are considered a waste. These are the following:

- Defects
- Overproduction
- Transport (moving of products)
- Waiting
- Excessive Inventory
- Motion (moving of people)
- Processing (unwanted process steps)
- Skills (lacking)

The main wastes were seven. Skills is an new addition.

Lean is much depended on the tools and methodologies that it utilizes. Some lean strategies that seem more successive for the concept and can be implemented in many different ways (e.g. merged), are [11]:

- 5S
- Automation
- Continuous flow
- Continuous improvement
- Kan-Ban
- Kaizen
- Six Sigma
- Total Quality Management (TQM)
- Value stream mapping (VSM)
- Work standardization
- Zero defects concepts
- Lean thinking
- Work in progress
- Flexible manufacturing system

### *2.1.3 Benefits from lean adoption*

The benefits from the implementation of lean can include many aspects, like the minimization or even elimination of waste, less work load, qualified and skilled workers, zero delays, saving time, reduction of costs, etc. [12].

Lean manufacturing changed the way that industry worked in the era of mass production and it presents many differences from the traditional manufacturing way. The major differences include [11]:

Higher flexibility, higher customer satisfaction, higher empowerment, shorter lead time, the inspection is performed in a 100% level and by workers, the inventories are produced per demand, the batch size is small and continuous, pull scheduling is implemented.

However, lean has not only domained the manufacturing field; it has also managed to enter in many more sectors, like service, trade etc. It has been also accepted as a new management system and a new term 'lean management', was created [13]. Hence, lean seems that can play a vital role in the management theory and practice, in order to produce a sustainable future for the enterprises.

### *2.1.4 Barriers and disadvantages from lean*

Lean implementation or the attempts to implement it, presents some drawbacks like the below:

- Every new concept and change in the workplace it is not easy to be accepted by the human workforce.
- Lean is not considered easy to be implemented in practice [14].
- The main scope of lean is to maintain industry stable without any disorders, but this is difficult to be applicable.
- The barriers created from the new concept, prevent the workers to perform their duties normally. However, lean thinking can contribute in overcoming those barriers, by creating a cooperative environment [14].
- Not every industry seems ready to accept the drastic changes of lean in production and quality [15].

## 2.2 Kaizen

Kaizen is a Japan-oriented strategy (also referred as culture, philosophy, approach, or methodology), which literally means continuous improvement (CI). It manages to involve all the workforce of an organization in its activities (e.g. Kaizen events, suggestion system) and it also highlights the importance of the workplace as the center of all actions, activities and processes. One of its main advantages is that it does not induce financial burdens to the organizations.

Its main philosophy is to produce small changes, which when taken together they can have a large impact. It utilizes the continuous improvement approach in every aspect of the organization.

It aims to involve workers from multiple functions and levels in the organization in working together to address a problem or improve a process. It requires skilled and well trained workers to achieve its scope.

It was first captured and implemented in big manufacturing sites, like the Toyota motor company. However, its philosophy was suggested that it can be implemented in every human life activity [16, 17]. Anywise, its main idea is that everyone and everything can change to the better, doing small steps.

It promotes process-oriented thinking [18] and continuous improvement of the standard way of work [19]. It is an endless effort for improvement, involving everyone in the organization [20]. The actions of mobilizing staff and encourage them to participate, could make them also responsible and able to contribute to the company's development [21].

Sometimes it is identified as a management approach (like TQM, Lean manufacturing, or company wide quality control), while other scholars considered it as a group of techniques and tools for cutting waste and finally others, appraised highly its success to intensify staff participation through its suggestion schemes [22].

The scholar that managed to introduce it in a formal aspect, was Imai, with his two books [16, 23], although the method still lacks a detailed explanation that would clarify better its theoretical context [22, 23]. Kaizen forms an umbrella that covers many techniques including Kanban, Total productive maintenance (TPM), Six Sigma, Just-in-time (JIT), suggestion system etc. [16]. According to [16], Kaizen is a continuous improvement process involving everyone. Broadly defined, Kaizen is a strategy to include concepts, systems, and tools within the bigger picture of leadership involving and people culture, all driven by customer [23]. Its success in uncovering a problem, making it visible, looking for its root causes and then eliminating them, was of extreme importance in the development of the manufacturing sector in countries such as Japan and Korea [24].

### *2.2.1 Kaizen actions*

One of the actions that Kaizen implements is the Kaizen event, which is a five-day (or six) team workshop defining specific goals for an area that requires improvement. A team leader will lead this event and will include training, data collection, brainstorming, and implementation. At the end of the event, the team leader will create a follow-up plan and a report to be submitted to management.

A typical Kaizen event may include the following

- Define goals and provide the necessary information
- Evaluate the current status and create a plan for improvements
- Implement planned improvements
- Review and fix what does not function
- Report results and determine any follow-up items.

The above cycle is also referred as PDCA (Plan, Do, Check and Act). This cycle is a vital part of the Kaizen philosophy.

### *2.2.2 The Key Players of the Kaizen Team*

Kaizen requires the support of an appropriate team with the right Team Roles. There are the following team roles.

- Champion: The champion is the person driving the train. It is normally a senior manager or executive who can defy barriers and inspires.

- Facilitator: Part coach, part trainer, and part leader, this person is typically well-versed in Lean and brings substantial experience to the table. At any given time, a facilitator may be overseeing several kaizen events in different stages.

- Team Leader: The team leader is in charge of the event and does most of the planning and preparation under the supervision of the facilitator. The team leader is often the manager, supervisor, or engineer in charge of the process being improved.

- Team Members: Team members are picked from the work area, from the stakeholders, or from the company at large. The best teams combine a variety of experience and skills. Teams typically range from 5–10 people depending on the size of the project.

- Stakeholders: Kaizen events influence a lot of people. Those people are known as stakeholders and should be included in decisions about the project.

- Support Team: Kaizen events often require support that goes beyond what team members can perform. This often falls on the facilities team and on IT.

*2.2.3 Kaizen umbrella (tools and techniques)*

Kaizen philosophy needs assistance to achieve its scope and therefore it includes many weapons (they called the Kaizen umbrella), such as the following:

- Total quality control

- QC circles

- Suggestion system

- Automation

- Kanban

- Just-in-time

- Zero defects

- New product development

- Quality improvement

- Total productive maintenance

- Small-group activities

Of course many of the above Kaizen activities, could also be part of the lean methodology, which sometimes includes a Kaizen project.

### 2.3 Lean-Kaizen

Lean-Kaizen is a new suggested approach of quality improvement in the literature that combines the two methodologies, which as already has been refereed, many times are implemented together and it is not such a surprise to see them combined together. However, it is also introduced as a new approach and will be presented as such, in this chapter.

The Lean-Kaizen technique, as a novel one, is composed of two basic words i.e. Lean and Kaizen which implies continuous elimination of waste through small-small improvements [25]. It is adopted for waste identification and elimination; it helps industry to be lean [26, 27]. It is a systematic way that focuses on continuous improvement of the process, productivity, and quality of the product by suggesting effective and efficient Kaizen events [10]. Leanness can also be defined in terms of efficiency and effectiveness of the manufacturing system [28].

The adoption of the Lean-Kaizen approach improves the organization output by solving problems through identifying and implementing small improvements in process, product, and system [29, 30]. So, the Lean-Kaizen approach is required to be implemented in order to produce quality products by eliminating waste Muda) in the entire system of the organization [31].

Quality is understood as a measure of excellence or a synonym of zero defects, zero deficiencies or absence of variations in the product by many industries. In order to achieve the desired product quality, the quality system performance is continuously monitored and evaluated for the sake of constant improvements of customer satisfaction, morale and reliability [32].

## 3. The contribution of the methodologies

### 3.1 Lean

#### *3.1.1 In which industries*

Lean and its strategies can eliminate all types of industrial waste [33]. Lean manufacturing has as a goal to eliminate waste and it succeeds in it without having to define additional requirements of resources [34, 35]. However, it seems that except the manufacturing sector, which gave birth to the concept of lean, many more industries have been profited from its power.

#### *3.1.2 In which fields*

Lean manufacturing contributed in improving manufacturing operations, protecting the industrial jobs and lift customer satisfaction [36].

The appropriate implementation of lean, improves the quality and the productivity and reduces the amount of inventory and work processes [37].

Except the improvement in productivity, lean manages to level up customer and employers satisfaction [36, 38].

The study of [39], presented the implementation of lean in various types of industries and it managed to achieve various types of waste reduction, manufacturing system design parameters and business value achievements.

In their study [40] concluded that despite the resistance to change in public organizations, the implementation of lean succeeded in the optimization of resources and the simplification of processes.

In a study in health care services, [41], noticed that waste was eliminated and quality was maximized, benefiting the customers.

Public sector seemed to be a nice field to implement the thinking of lean, as there is many waste and the needs for better quality are more than before.

Therefore, continuous improvement approaches have been formally applied in the public sector all over the world, in an attempt to improve service quality and streamline processes, often in response to cuts in public expenditure budgets imposed by governments.

New Public Management (NPM), a new theory, emerged as the supporting doctrine to this policy, that advocated the imposition in the public sector of management techniques and practices drawn mainly from the private sector, as according to NPM greater market orientation would lead to better cost-efficiency, with public servants becoming responsive to customers, rather than clients and constituents, with the mechanisms for achieving policy objectives being market driven.

A new effort that contributes in examining lean in the public sector is the "Lean in public sector" project (http://leaninpublicsector.org/). Launched in 2007, the aim of LIPS was to extend lean project management to public sector construction projects. Its scope is to include the application of lean thinking to government operations generally so that new facilities support, new and more effective ways of delivering government services.

Some of the successes of this project, include:

- Introducing the lean management philosophy and methods to Australia's project alliancing.

- Following the pioneering work of the Finland's Transportation Agency, a range of Finnish government organizations has successfully applied lean and Integrated Project Delivery (IPD) principles to over 35 projects since 2009 with more on the way.

- At the 2013 conference it was announced that the European Commission ruled against a challenge to the contract award of one of those Finnish projects, thus providing proof that integrated project delivery is legal under EU construction procurement regulations.

- In the US, the University of California, San Francisco (UCSF) has led in the development and testing of alternative contract structures and methods of aligning commercial interests, and this without multi-party contracts, which are not currently allowed for the university system.

- The California state university system and many community college systems are also successfully applying lean concepts and methods within the limits of current regulations.

### 3.2 Kaizen

Some examples of Kaizen implementation and success are presented in the **Table 1**.

It can be concluded that Kaizen has also been implemented in organizations of all business industries and provided valuable solutions.

| Authors | Industry | Tools, actions | Results |
|---|---|---|---|
| [42] | Manufacturing foods product | 5s Technique, team training | Decrease in quality rejections, reduction in change over times and increase in manufacturing activities. |
| [43] | Industrian technology | Kaizen approach and lean thinking | Reduction in space used, material handling costs, lower scrap rates. |
| [44] | Manufacturing industry | Six sigma, JIT | Eliminate waste, increased sales. |
| [45] | Manufacturing | Kaizen event, inventory management Kaizen, | Reduced process time |
| [46] | Public agricultural organization | Kaizen project, 5S, | Process improvement, shorten work processes, decrease n financial expenses |
| [47] | Semiconductor industry | Kaizen technique | Cost reduction, |
| [48] | Automobile assembly production line | Set-by-step kaizen procedure | Elimination of major functional problem, reduction in quality rejections, elimination of rework processes. |

**Table 1.**
*Kaizen implementation examples and results.*

## 4. Conclusion

Having realized the potential of Kaizen and Lean, even big consulting organizations have dedicated many writing in presenting and exploring the methodologies. Consulting companies are organizations that provide professional services in other companies in the fields of marketing, financing, ICT, logistics, business plans etc. Some of the biggest consulting companies worldwide are: Deloitte, McKinsey, EY, Boston consulting company.

For example Deloitte has attempted to connect Lean with Industry 4.0* and has presented many other cases of lean implementation in several fields. Some links of relevant articles follow:

https://www2.deloitte.com/us/en/insights/focus/industry-4-0/digital-lean-manufacturing.html

https://www2.deloitte.com/us/en/blog/human-capital-blog/2020/lean-strategic-planning-design-thinking-agile-what-does-it-all-mean-in-becoming-exponential-hr.html

https://www2.deloitte.com/content/dam/Deloitte/ca/Documents/life-sciences-health-care/ca-en-life-sciences-health-care-lean-in-health-care.pdf.

https://www2.deloitte.com/us/en/insights/focus/industry-4-0/digital-lean-manufacturing.html.

* Industry 4.0 is the concept of creating a digital enterprise by establishing digital technologies and integrates them with advanced production and operation techniques.

McKinsey, also a big consulting organization, has presented some analytical guides and presentation of the methodologies. Many of them are evident in financial institutions and the links of some follow:

https://www.mckinsey.com/business-functions/operations/our-insights/the-work-of-leaders-in-a-lean-management-enterprise

https://www.mckinsey.com/~/media/mckinsey/industries/consumer%20packaged%20goods/our%20insights/the%20consumer%20sector%20in%202030%20trends%20and%20questions%20to%20consider/2014_lean_management_enterprise_compendium.pdf

https://www.mckinsey.com/~/media/mckinsey/dotcom/client_service/financial%20services/latest%20thinking/reports/lean_management_new_frontiers_for_financial_institutions.pdf

https://www.mckinsey.com/business-functions/operations/our-insights/next-frontiers-for-lean

Digital lean

Digital lean is an example of the integration of digital technologies and lean principles It utilizes lean theory to decrease the waste in digital technology actions and processes.

Digital lean uses Industry 4.0 and other digital tools to create the appropriate information for all operations and processes. As data come in a high frequency way, it can be managed and directed in the appropriate resources.

Digital lean can be a valuable asset and some of its achievements are: reduced costs, improved quality and higher return on investment, compared with any other methodology that is implemented individually.

Lean Industry 4.0

A new concept deriving from the combination of lean and Industry 4.0 is presented.

The main scope of lean is to reduce waste in the value chain, focusing on client's value and strengthening the role of the employees in all this process [3].

On the other hand, the basis of Industry 4.0 is the ability to quickly collect, process, analyze and exchange large data sets between machines. Thanks to modern technologies such as: Cyber-Physical Systems (CPS) or Internet of Things (IoT), it is possible to react faster and more flexibly to existing problems, but also to more efficient value creation processes, while reducing costs [49].

A suggested solution is the combination of the above concepts, in order to solve the problems that modern production faces. Despite, the significant differences, between the two concepts, they seem to have the same goal, to increase added value [50].

### 4.1 The present and future of the methodologies

Lean can provide solution in many fields and it is evident that even service companies embrace and appreciate it [51]. Lean reached functions that previously seemed quite difficult to transform. (management principles once known as lean manufacturing [52].

The new concept of lean management, which introduces the values of lean in the modern management, has been adopted by many organizations. It provides a roadmap that holds the organization (and the workflow) stable and able to solve all of the derived problems. The primary winner of these efforts is the customer and then consequently the organization.

Lean seems not to be a static methodology. It is still developing and could be a valuable solution for many enterprises [53]. Lean can be fitted in the rapid changing world, which seems to be even more intense after the COVID-19 crisis. The Toyota lean business system has managed to deliver: better quality, productivity, customer focus, innovation, employee engagement, profitability and even environmental sustainability [54]. Organizations should concentrate on involving all employees in the continuous improvement organizing appropriately the value stream and offer

the ideal products and services for the customers. Money and profit should not be their main incentives, as customers have improved demands and there is intense competition.

Questions that challenge current entrepreneurship could be, how well large, modern organizations work as almost as old as management [52]. Problems that could affect organizations are: slower growth, debt burdens, aging workforces, mismatches between worker skills and available jobs.

There are successful organizations that attain a state of continuous improvement. Their performance is consistent in the short and long run. However, it is not always effective for every organization to imitate best practices.

Hence, lean management system [13] could be in the forefront of the management field, in order to provide valuable solutions. Its main aspect, which is to improve material flows, could be a valuable asset.

Lean can contribute in the appropriate integration of the technology field in the organizations, as it can provide valuable information with the customers' feedback [54].

The lean system could assist information management system to solve their information flow problems. If the information provided is the essential and appropriate, the information system could be benefited and improve its performance.

The information gathered with many ways and directed appropriately, could be an instrument to link this information with direct customer needs and inform the relevant departments in an organization.

From all the cases and the thoughts about Lean reported in this study, it is evident, that it is a philosophy that can be an asset in the management field and the question is if the organizations could make the right choices and be benefit from its positive aspects.

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## References

[1] Ohno, T., 1988, Toyota production system: beyond large-scale production, CRC Press.

[2] Vinodh, S., Arvind, K. R., and Somanaathan, M., 2011, Tools and techniques for enabling sustainability through lean initiatives, Clean Techn Environ Policy, 13, pp. 469-479.

[3] Womack, J. P., Jones, D. T., & Roos, D. 1990. Machine that changed the world. Rawson.

[4] Hu, Q., Mason, R., Williams, S. & Found, P. 2015. Lean implementation within SMEs: a literature review. Journal of Manufacturing Technology Management, Vol. 26 Iss: 7, pp.980-1012, 26(7), 980-1012.

[5] Hall, R.W. 1983. Zero Inventories. New York: McGraw Hill.

[6] Assessing changes towards lean production, Christer Karlsson and Pär Åhlström, 1996, International Journal of Operations & Production Management, Vol. 16, No. 2 1996, pp. 24-4.

[7] P. BURCHER, S. DUPERNEX, R. GEOFFREY, "The road to lean repetitive batch manufacturing: modelling planning system performance", International Journal of Operations and Production Management, 16 (2) 1996, pp. 210-221

[8] Hines, P., Found, P., Griffiths, G. and Harrison, R. 2010. Staying Lean. New York:Productivity Press.

[9] Shah, R. and Ward, P.T. 2003. Lean manufacturing: context, practice bundles, and performance. Journal of Operations Management, 21(2), 129-149.

[10] J.K. Liker, The Toyota Way: 14 Management Principles from the World's Greatest Manufacturer Hardcover, 2003, McGraw Hill,

[11] Chahal V., & Narwal M.S, 2017, An empricial review of lean manufacturing and their strategies, Management Science Letters vol. 7, pp.321-336.

[12] Abdollahi, M., Arvan, M., & Razmi, J. 2015. An integrated approach for supplier portfolio selection: Lean or agile? Expert Systems with Applications, 42(1), 679-690.

[13] Emiliani, B. (2013), The Lean Professor: Become a Better Teacher Using Lean Principles and Practices, The CLBM, LLC, Wethersfield, CT.

[14] Roslin, E. N., Shamsuddin, A., & Dawal, S. Z. M. 2014. Discovering Barriers of Lean Manufacturing System Implementation in Malaysian Automotive Industry. In Advanced Materials Research (Vol. 845, pp. 687-691). Trans Tech Publications.

[15] Harris, G., Stone, K. B., Mayeshiba, T., Componation, P. J., & Farrington, P. A. 2014. Transitioning from teaching lean tools to teaching lean transformation. Journal of Enterprise Transformation, 4(3), 191-204.

[16] Imai, M. 1986. Kaizen-the key to Japan's competitive success. New York, NY: Random House.

[17] Wittenberg, G. 1994, "Kaizen, the many ways of getting better", Assembly Automation, Vol. 14 No. 4, pp. 12-17.

[18] Hammer M, Champy J and Tathan R L 1993, Reengineering the Corporation:A Manifesto for Business Revolution, Harper Collins, New York.

[19] Chen J C, Dugger J and Hammer B 2000, "A Kaizen Based Approach for Cellular Manufacturing Design: A Case Study", The Journal of Technology Studies, Vol. 27, No. 2, pp. 19-27.

[20] Malik S A and YeZhuang T 2006, "Execution of Continuous Improvement

Practices in Spanish and Pakistani Industry: A Comparative Analysis", IEEE International Conference on Management of Innovation and Technology, Vol. 2, pp. 761-765, Singapore.

[21] Bessant, J. 2003, High Involvement Innovation, Wiley, Chichester.

[22] Suárez-Barraza M.F. & Rodríguez-González, F.G. 2015 Bringing Kaizen to the classroom: lessons learned in an Operations Management course, Total Quality Management & Business Excellence, 26:9-10, 1002-1016, DOI:10.1080/14783363.2015.1068594.

[23] Imai, M. 1997. Gemba Kaizen. New York, N.Y.: McGraw-Hill.

[24] Singh, J. and Singh, H. 2009, "Kaizen philosophy: a review of literature", The IUP Journal of Operations Management, Vol. 8 No. 2, pp. 51-72.

[25] Suarez-Barraza, M. F., Smith, T., and Dahlgaard-Park, S. M., 2009, Lean-kaizen public service: an empirical approach in Spanish local governments, The TQM Journal, 21(2), pp. 143-167.

[26] Prashar, Anupama, 2014, Redesigning an assembly line through Lean-Kaizen: an Indian case, The TQM Journal, 26(5), pp. 475-498.

[27] Suarez-Barraza, M. F., Ramis-Pujol, J., and Kerbache, L., 2011, Thoughts on kaizen and its evolution: Three different perspectives and guiding principles, International Journal of Lean Six Sigma, 2, pp. 288-308.

[28] Singh, Bhim, Garg, S.K., and Sharma, S. K., 2010, Development of index for measuring leanness: study of an Indian auto component industry, Measuring Business Excellence, 14(2), pp. 46-53.

[29] Panwar, Avinash, Jain, Rakesh, and Rathore, A.P.S., 2015, Lean implementation in Indian process industries – some empirical evidence, Journal of Manufacturing Technology Management, 26(1), pp.131-160.

[30] Singh, B., Garg, S. K., and Sharma, S. K., 2010, Scope for lean implementation: a survey of 127 Indian industries, International Journal of Rapid Manufacturing, 1(3), pp. 323-333.

[31] Bhuiyan, N., and Baghel, A., 2005, An overview of continuous improvement: from the past to the present, Management Decision, 43(5), pp. 761-771.

[32] Sunil Kumar, Ashwani Kumar Dhingra, Bhim Singh, 2017, Implementation of the LEAN-KAIZEN approach in fastener industries using the data envelopment analysis, Mechanical Engineering Vol. 15, No 1, 2017, pp. 145-161

[33] Belekoukias, I., Garza-Reyes, J. A., & Kumar, V. 2014. The impact of lean methods and tools on the operational performance of manufacturing organisations. International Journal of Production Research, 7543(July 2014), 1-21. http://doi.org/10.1080/00207543.2014.903348

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

[35] Vamsi, N., Jasti, K., & Kodali, R. 2014. A literature review of empirical research methodology in lean manufacturing. International Journal of Operations & Production Management, 34(10), 1080-1122. http://doi.org/10.1108/IJOPM-04-2012-0169

[36] Singh, B., Garg, S. K., Sharma, S. K., & Grewal, C. 2010. Lean implementation and its benefits to production industry. International Journal of Lean Six Sigma, 1(2), 157-168.

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

[38] Rose, A. N. M., Md. Deros, B., & Ab. Rahman, M. N. 2013. A study on lean manufacturing implementation in Malaysian automotive component industry. International Journal of Automotive and Mechanical Engineering, 8(1), 1467-1476. http://doi.org/10.15282/ijame.8.2013.33.0121.

[39] Yudha Prasetyawan, Mokh Suef, Nauval Rifqy, Intan Oktasari Kusuma Wardani, 2019, Manufacturing strategy improvement based on lean methodology, IOP Conference Series Materials Science and Engineering 508(1):012095.

[40] Renato Lopes da Costa , Tiago Resende Leandro Ferreira Pereira, , Álvaro Lopes Dias, Jose Santos., 2020, Public Sector Shared Services and the Lean Methodology: Implications on Military Organizations, September 2020, Journal of Open Innovation Technology Market and Complexity 6(78):1-13.

[41] Rubin Cohen , 2018, Lean Methodology in Health Care, June 2018Chest 154(6), DOI: 10.1016/j.chest.2018.06.005.

[42] Lee M 2000, "Customer Service Excellence Through people motivation and Kaizen", IEE Seminar, "Kaizen: from Understanding to Action" (Ref. No. 2000/035), Vol. 5, pp. 1-21.

[43] Lee S S, Dugger J C and Chen J C 2000, "Kaizen: An Essential tool for Inclusion in Industrial Technology Curricula", Journal of Industrial Technology, Vol. 16, No. 1, pp. 1-7.

[44] Ashmore C. 2001, "Kaizen and the Art of Motorcycle Manufacture", Manufacturing Engineer, Vol. 80, No. 5, pp. 220-222.

[45] Palmer V S 2001, "Inventory Management Kaizen", Proceedings of 2nd International Workshop on Engineering Management for Applied Technology, pp. 55-56, Austin, USA.

[46] Dehghan R, Zohrab M, Momeni A and Hoseini M 2006, "Continuous Improvement Approach in the Agriculture Sector", Asian Pacific Productivity Conference, Seoul National University, South Korea, available on http://www.fdp.ir

[47] Kikuchi K, Kikuchi T and Takai T 2007, "Method of Overall Consumable Effectiveness", IEEE International Symposium on Semiconductor Manufacturing, pp. 1-4, Santa Clara, USA.

[48] Chandrasekaran M, Kannan S and Pandiaraj P 2008, "Quality Improvement in Automobile Assembly Production Line by Using Kaizen", Manufacturing Technology Today, Vol. 7, No. 3, pp. 33-38.

[49] Oztemel, E., & Gursev, S. 2018. Literature review of Industry 4.0 and related technologies. Journal of Intelligent Manufacturing, 31, 127-182. https://doi. org/10.1007/s10845-018-1433-8.

[50] Prinz, C., Kreggenfeld, N., & Kuhlenkotter, B. 2018. Lean meets Industrie 4.0 – A practical approach to interlink the method world and cyber-physical world. Procedia Manufacturing, 23, 21-26. https://doi.org/10. 1016/j.promfg.2018.03.155. Current trends and future perspectives, Cogent Business & Management, 7:1, 1781995.

[51] Lean management: new frontiers for financial institutions McKinsey, 2011, https://www.mckinsey.com/~/media/mckinsey/dotcom/client_service/financial%20services/latest%20thinking/reports/

lean_management_new_frontiers_for_financial_institutions.pdf

[52] McKinsey: the lean management enterprise, 2014a. https://www.mckinsey.com/~/media/mckinsey/industries/consumer%20packaged%20goods/our%20insights/the%20consumer%20sector%20in%202030%20trends%20and%20questions%20to%20consider/2014_lean_management_enterprise_compendium.pdf

[53] McKinsey,2014b, article-Next frontiers for lean, https://www.mckinsey.com/business-functions/operations/our-insights/next-frontiers-for-lean

[54] D.T.Jones, 2020, https://planet-lean.com/lean-management-post-covid19/)

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