

LEAN JOURNEY SUCCESS FACTORS – A CASE STUDY OF LEAN TOOLS IMPLEMENTATION SEQUENCE IN A MANUFACTURING COMPANY

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Purpose: The study aim is an in-depth investigation of a Lean tools implementation sequence in an organisation as an expression of a Lean journey within that organisation. The success factors of Lean tools implementation and the relationship between them are studied. A model of Lean tools implementation in an organisation is aimed to be developed.

Design/methodology/approach: A case study method is employed in this study. It is conducted in a manufacturing company from the fast-moving consumer goods (FMCG) industry. The employed method allows exploitation of a variety of techniques in the investigation process: in-depth interviews, observations, documents and data analysis. The study takes into consideration a systematic literature review and bibliometric network analysis supported by the Vosviewer software tool.

Findings: The implementation of Lean Manufacturing approach, along with accompanying tools and methods, is aimed at efficiency and/or quality results of the processes within a company. Selected tools, to be successfully implemented, should support the elimination or reduction of losses related to current process flows. There are many Lean tools available, but most do not fit all organisations and all the kinds of manufacturing processes. Therefore, proper preparation before implementation is an essential issue for any organisation striving for Lean outcomes. The available Lean tools, along with their implementation sequences, are not studied comprehensively in the literature.

Originality/value: An organisational-development-driven model of Lean tools implementation is elaborated, based on the literature and empirical investigations. The decision to choose the appropriate Lean tool should be guided by general organisational development. Several factors need to be considered before the implementation process, namely, capabilities, resources, gains and return on expenditure. Top management engagement, appropriate communication and listening to line employees look to be key success factors in Lean tools implementation.

Keywords: Lean Manufacturing, Lean tools, Lean implementation.

Category of the paper: Research paper, Case study.

1. Introduction

Lean is a methodology that delivers superior performance for an organisation. This entails delivering for customers more value from existing resources with fewer additional costs. An extensive review of the literature on Lean implementation identified many managerial and organisational factors that should be developed in order to implement all Lean practices in effective ways (Aij, Teunissen, 2017; Antony, Gupta, 2019; Yadav, Desai, 2017).

Previous research has focused on a detailed and comprehensive understanding of which factors are key to Lean implementation and how they impact performance improvement (Netland et al., 2019). However, the researchers did not conclude whether and to what extent these factors are implemented in practice (Knol et al., 2018). Therefore, it seems that research that focuses on a detailed examination of implementation practices and identification of success criteria is necessary. Special attention has to be focused on Lean tools, which are tangible forms of the Lean approach's existence in the organisation.

The Lean Manufacturing approach reveals the proper tools to be used for starting and sustaining a continuous-improvement culture across an organization (Karem, 2017). There are many Lean tools available, but most do not fit all organisations and all the kinds of manufacturing processes. The choice of a Lean tool possibly depends on the specific production process in a company; however, this is not reported in the literature. Another closely related issue is the success factors that should be met in order to effectively implement given Lean tools. This study is an in-depth investigation of a sequence of Lean tools implemented in an organisation as an expression of the Lean journey within that organisation. The study presents a systematic literature review and bibliometric network analysis supported by the Vosviewer software tool. A case study method is employed; it is conducted in a manufacturing company from the fast-moving consumer goods (FMCG) industry. The work towards a management useful model of Lean tools implementation is undertaken.

2. Lean tools interconnection according to bibliometric measures

Lean tools are designed to reduce the main losses in organisations and improve quality control. They also strive to eliminate processes that are not valuable. Lean tools are utilised across many industries from manufacturing to engineering to finance and medicine. Some of them are techniques for managing people, and some are frameworks for solving problems, while others offer ways of thinking about structuring work (Brandenburg, Ellinger, 2003). All of these Lean tools are designed to eliminate waste, increase efficiency and make the most

of resources. Nowadays, for many manufacturers, Lean is an essential system that helps them maximise their potential while reducing their carbon footprint and overall spend.

Lean tools focus on efficiency improvement and continuous improvement of processes (Dresh, 2018). For example, according to some sources Kaizen is also perceived as a Lean tool, which customises correctly according to an organisation's need and can support continuous improvement in safety, quality, processes and productivity (Womack, Jones, 2003). At the same time, a whole improvement movement within the organisation is also named 'Kaizen'. The idea behind Kaizen is that every employee, regardless of position in the hierarchy, can share ideas which could help improve processes.

All these tools have significant meanings in a Lean implementation; however, tools must not be copied directly from the literature. Lean practices and tools should be adapted carefully for each organisational framework to achieve continuous improvement and long-term results in the enterprise. To identify the most popular Lean-manufacturing methods and terms discussed in literature, analysis of the articles has been conducted from the database Web of Science. Figure 1 below presents the results of such research as a network diagram. To prepare this, the visualisation software tool Vosviewer has been employed. The analysis includes 1471 articles published after the year 2000. The search has been narrowed by using keywords such as: 'continuous improvement', 'implementation' and 'performance' or 'lean manufacturing tool'. Additionally, in this research, attention has been paid to three main categories connected with the production and manufacturing areas: 1) management or industrial engineering, 2) mechanical and 3) multidisciplinary or manufacturing engineering.

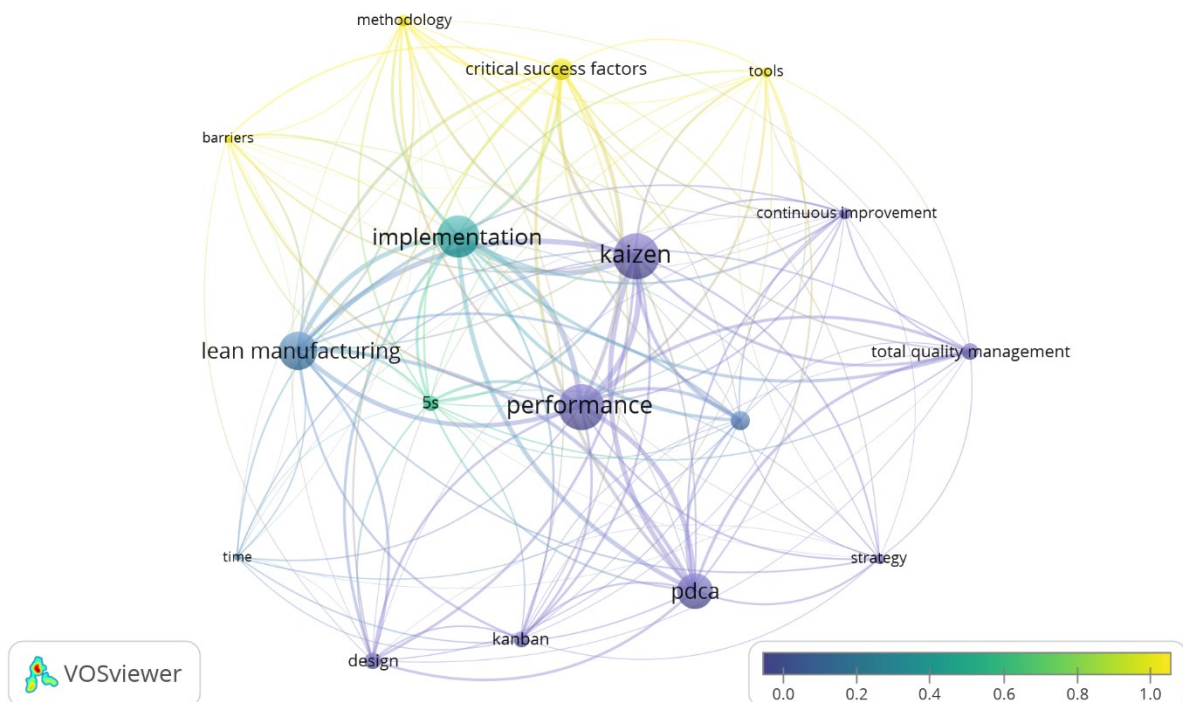


Figure 1. Bibliometric network diagram.

Source: own elaboration.

The network diagram (Figure 1) introduces the most popular Lean Manufacturing methods and terms based on the Web of Science Core Collection. The number of connections are of special importance in its analysis. In the same group, PDCA and Kaizen were identified as having strong connections with total quality management, performance and implementation. In total quality management, PDCA is a fundamental tool to improve processes in organisations. The PDCA cycle effectively provides a feedback mechanism about the current status of the implementation and helps develop continual quality improvement. In the second group, a strong connection was identified between the general term 'implementation' with Kanban, 5S and time. In the third group, critical success factors have a network of connections around elements such as barriers, tools and methodology. This means that the Lean method should be selected appropriately to the needs of the company, depending on the problems that need to be eliminated. The success of implementation depends not only on the tools applied or the new processes mapped out but also on how willing the organisation is to undergo a cultural change and reach organisational maturity. The methods for implementing this approach come from the experts – such quality leaders as Philip B. Crosby, W. Edwards Deming, Armand V. Feigenbaum, Kaoru Ishikawa and Joseph M. Juran (Deming, 2012; Ishikawa, 1985; Juran, Godfrey, 2000).

5S implementation as part of daily life within a company means much more than improved organisation, sustained cleaning routines and efficient activity flows. By using the 5S methodology, operators are encouraged to improve their overall work environment and reduce waste (*muda*) (Gupta, Jain, 2014). For example, 5S is a foundational part of the Toyota Production System because until the workplace is in a clean, organised state, achieving consistently good results is difficult. The lack of properly managed space may lead to mistakes, slowdowns in production and even accidents, all of which interrupt operations and impact the company in many negative ways. The PDCA cycle is a method used to coordinate a continuous improvement project. This approach helps companies to carry out improvements systematically. It leads the improvement towards the direction of preventing error recurrence by establishing cyclical standards of work and continuing standardization (Moen, Norman, 2009).

Kanban in the manufacturing industry is considered a Lean Production method by managing the production and supply of components according to the demands of the specific production order (Moen, Norman, 2009). The size and sequence of production orders are adjusted to market demand. In this way, exactly as much is produced as is currently needed (Weiss, 1988). Kanban was developed at Toyota and revolutionised their production. Kaizen is a management approach focused on continuous improvements in operations. Different elements of Kaizen are being utilised by the manufacturing industry to improve the performance of current manufacturing-system processes (Singh J., Singh H., 2017). Kaizen can be considered a strategy where employees at all levels of the company work together proactively to achieve regular, incremental improvements to the manufacturing process.

3. Views in the literature on Lean tools implementation success factors

Based on survey data from 1757 large, medium and small US manufacturing firms (Shah, Ward, 2003), the synergistic effect of all Lean practices was associated with better operational performance. When products are produced in a single-piece flow and value-added activities follow each other continuously, operational performance increases. To successfully implement Lean practices, organisations need to continuously improve their processes. Thanks to this research, it should be known which of these methods are the most popular and which key success factors are the most important during Lean implementation.

During the implementation of Lean projects in an organisation, functional team leaders assume responsibility for it (Coetzee et al., 2019). Another important element is the fact that successful implementation involves many factors. It should be taken into account which tools have been selected, what approach has been used, and what is the current state of knowledge and experience of managers and production workers about Lean (Seidel, Saurin, 2020). Most studies nowadays take a broad perspective when analysing critical implementation factors. Leadership practices are presented as a general list of recommendations (Katayama, 2017). Therefore, in order to gain a more thorough understanding of specific relevant factors, it is necessary to focus on the subset of factors that are most relevant to the organisation and study them in more detail during practical implementation.

After systematic analysis of the literature, key success factors for an effective Lean implementation can be summarised. The results are presented in Table 1.

To identify the key success factors during Lean implementation, a review of scientific articles published in last 20 years was carried out and the 10 most common factors in the literature were selected. Many factors affect the implementation of Lean initiatives. An analysis of the literature reveals that three factors emerge as being particularly important: commitment of top management, learning focus and an appropriate communication model. Nevertheless, all 10 factors are extremely important during Lean implementation. Depending on the size of the organisation and the company's advancement in a culture of continuous improvement, these factors are conducive to achieving higher results during implementation. Identification of these factors is an important part of the case study conducted on the research object (company). Thanks to this, it is possible to verify if managers can confirm that these key success factors have a connection with practical Lean implementation in the company.

Table 1.
Key success factors in Lean implementations

Key success factor	Description	Authors								
		Connor, Cormican, 2021	Yadav, Desai, 2017	Laureani, Antony, 2017	Jedynak, 2015	Tari, 2005	Garcia et al., 2014	Rymaszewska, 2014	Knol, et al., 2018	Morito et al., 2017
Commitment of top management	Top management take part in Lean activities on production lines and have an open approach to new ideas. They consider all effective ideas elaborated by shop-floor employees.	X			X			X		X
Realistic success criteria	Lean activities support achieving the main goals of the company. Lean focuses on the biggest bottlenecks in the company (top three losses).	X				X	X	X	X	X
Appropriate communication model	Each employee has access to information and the same understanding of Lean. Ideas and knowledge are exchanged honestly, clearly and transparently.	X	X	X				X		X
Education and training	Managers and shop-floor employees take part in training focused on improvement concepts, tools, techniques and team building. Each identified lack of knowledge is supported by training.	X		X	X		X			
Effective system of awards and recognition	The organisation recognises the most engaged employees and creates a positive environment to support them in development.	X	X	X					X	X
Appropriate selection of the implementation team	The team responsible for implementation has knowledge and experience in production processes and fully understands Lean methodology and opportunities.	X		X		X	X		X	
Performance management system	Process data from all levels is measured and visualised to control production, prevent defects and indicate opportunities for improvement.			X	X	X			X	X
Focus on production workers	All accurate suggestions are considered and implemented to improve business performance. There is an open model of communication in the organisation.	X	X		X			X	X	X

Cont table 1.

Sufficient resources	Sufficient time and money are available for training, analysis and improvement activities. Top management is open to new implementation solutions.	X				X			X		X
Learning focus	Both positive and negative experiences are discussed, and mistakes are considered opportunities for improvement rather than deserving of punishment.	X		X	X						X

Note. In table “X” means that authors identified given factor in the study.

4. Case study investigation protocol

In this research, case study methodology has been chosen to examine the practical sequence of implementing methods in the company and verify why the company decided on this order. Also, another important issue is to check the correctness of implementing the methods, in accordance with the methodology and assumptions. This approach allows usage of different techniques when analysing the data: quantitative and qualitative, depending on the context.

This case study was conducted in a FMCG manufacturing company. It is a company that has been implementing Lean Manufacturing over the last six years, gradually expanding the scope of implementation with new tools and methods. About 1,500 employees work at the studied facility. The respondents for in-depth interviews were employees and managers who were deliberately selected from the departments related to the implementation of Lean, namely: production, administration, planning and logistics. Data collection was performed within the company through observation and structured-interview techniques with these respondents. Additionally, interviews were conducted with managers to understand the production processes and obtain better knowledge of the Lean functionality and the benefits that had been achieved. There was also a physical on-site visit to the manufacturing facility. The investigation will be focused on four Lean methods: 5S, Kanban, Kaizen suggestion system and PDCA.

While collecting data in the company, the managers took part in open-ended interviews based on the research scenario. A sequence of queries had been prepared to ensure the accuracy and quality of the field investigations. Each of the queries served as the beginning for a series of ‘digging’ questions asked of an interviewee; the list of queries is presented below:

1. Which methods were practically and effectively implemented in your company?
2. What was the motivation to introduce each of the methods?
3. How the implementation process was going on, what were the implementation steps?
4. Were the methods modified and/or adjusted to suit the company’s needs? What exactly was changed?

5. What benefits have the organisation achieved thanks to the methods?
6. What were the difficulties and obstacles during implementation and later use?
7. What were important factors that enabled smooth and efficient implementation of the methods?

To perform the evaluation of Lean implementation even better, deep analysis of the provided documentation was conducted. In order to understand it correctly it was essential to conduct interviews with employees from a variety of departments, as indicated above.

5. The case study findings

Figure 2 shows a visualisation of the implementation of particular Lean tools in the investigated manufacturing company. At the beginning, in 2015, the company decided to implement the 5S method to improve safety and provide proper organisation at the workplace. 5S allows achievement of higher efficiency by faster execution of orders, quality improvements and most importantly – less likelihood of accidents. After a positive impact on daily work was achieved, the decision about PDCA implementation was made. It was responsible for timely problem solving and elimination of the lack of standardisation in terms of action-taken and results achieved. The company wanted to build a continuous improvement culture to manage problems in an effective way. Seeing the business benefits of previous development projects in 2018, the organisation decided on a Kanban implementation in response to waste (material losses for production orders). This decision was based on deep analysis of the potential benefits. Before implementation, managers elaborated the success factors for this initiative. Finally, after four years of developing a continuous improvement approach in the company, they decided on one. It was a Kaizen technique – a suggestion system, referred to as ‘Kaizen cards’. Employees were allowed to report suggestions and ideas that could improve safety, quality and efficiency in the organisation.



Figure 2. Lean tools implementation sequence in the studied company.

Source: own elaboration.

5.1. The 5S method

At first, the studied company decided on this method because it is a basic method that shows production workers the benefits of organising the workplace and complying with standards in a simple and inexpensive way. The organisation struggled with the problem of disorderly workplaces and losses in production, which were related to the search for basic fast-rotating parts to be replaced on production machines and appropriate tools for cleaning, inspection and lubrication of components on the production line. After some training for managers, the first production line was selected, since it had the greatest mess according to the production workers. The most important element of the line training was to convince the participants that this solution could help them in daily work and they would be better able to work in a standardised workplace. All participants of the training spent the entire day on the production line together with the project leader. It started with taking photos, to be able to make a comparison of before and after the implementation. Another task was to separate the things needed from those that were unnecessary in the workplace. Then, the places for individual tools and items were designated and signed using coloured tape and purchased containers/drawers. All suggestions of what should stand (and where) were suggested by the employees of the production line. It was they who designed the perfect workplace for themselves. Only in this way were they able to accept such a big change and get used to the new order. After the entire workplace was standardised and a summary photo was taken, the opinions of the entire production team were collected. This took place one week after work on this system was completed. After positive recommendations, a 5S implementation plan was created on other production lines, as well as on communication routes. This solution was also introduced for the positions of office workers. Three months after the implementation, the company had a problem with maintaining the 5S standard in its original form. The problem was connected with the differing levels of employee motivation and also with new production workers in the organisation. The project manager responsible for 5S has now developed a 5S mini-audit as a control element, which is performed monthly on each production line by the managers responsible for particular production areas. This helps to keep the 5S plan working properly. The main benefits that the company has achieved are the improvement of working conditions on production lines, production machines maintained in better condition (in terms of cleanliness) and thus better efficiency results. As reported by interviewed managers, some cost components have been slightly reduced after 5S implementation across the entire factory. The key success factor during 5S implementation was appropriate communication between all sites engaged.

5.2. The PDCA method

After the successful implementation of 5S, the organisation was ready to take another Lean initiative but were not sure in which direction to go. Therefore, they decided to conduct a loss analysis in each of the departments and select the main loss that should be eliminated (or reduced to a minimum). When each department had selected a problem to be solved, it conducted an internal workshop of high-level managers with over 10 years of experience in manufacturing companies. Together with the external company that specialises in Lean methodology, they decided to implement PDCA. For this purpose, an organisational PDCA model board was designed, according to which each department should work. Individual elements had been selected in such a way as to create an endless cycle of continuous improvement supporting the work of each department. In order to ensure timely implementation and to have full control over work progress, regular meetings (once every two weeks) of the head of the department were scheduled, with members from the department responsible for implementation of individual elements. In the event of any activities being delayed, the team considered together what they should change or who else should be asked for help. In this way, the department manager had full control over solving the given problem. After completing the implementation phase, the functionality of the solution was checked for the next four weeks. The organisation designed this PDCA model by considering their business needs. If it turned out that full success was achieved, they moved to the next problem. If not, an analysis was performed to identify errors during implementation, with the creation of a recovery plan that supported achievement of the goals. The main barriers to implementing PDCA focused on the planning phase, namely, there was a problem with erroneous data collection and identification of the root cause of the problem. The organisation sees huge potential in the application of the PDCA cycle and constantly invests in training employees in appropriate understanding of individual elements of the cycle. The culture of continuous improvement, identifying main losses and eliminating them positively influences the improvement of business results. This solution influenced problem-solving time, reducing it on production lines by 20%. The key success factors in PDCA implementation were the commitment of top management and the use of an appropriate communication model.

5.3. The Kanban method

After conducting the annual loss analysis, the company identified waste with the amount of material losses for production orders. It often happened that the ends of the materials stored in the warehouse took up pallet places or were disposed of and did not return to production on the same order. By analysing the available Lean methods, Kanban responded to the needs of this problem. A project group had the task to design a solution that would reduce material losses in the organisation. They started with an analysis of data for individual production orders. On this basis, it was possible to determine what amount of a given material was needed to produce a particular order. Kanban cards were created for each type of end product. In addition, an analysis of the size of materials used in production was carried out and special Kanban trolleys were designed, which were delivered to a given production line with the appropriate amount of material for the order. In the event of a change of orders, the warehouse worker delivered a new Kanban cart with the materials for the new order, and the Kanban from the previous order was taken back. Thus, the utilisation of warehousing work equalled 100%. The greatest difficulty in implementing this solution was to indicate the percentage of stock that should be accepted for each production order so that the material loss was as small as possible and the production order was 100% fulfilled. Production workers were engaged to determine this figure using all available detail. Compared to other tasks, it was the most time-consuming. Ultimately, the project turned out to be a success; the company reduced material losses by about 20% and reduced material stock in the warehouse by 15%. In this Kanban implementation, the key success factor was a focus on production workers.

5.4. Suggestion system

Earlier Lean projects showed how big effects can be achieved due to the appropriate implementation of particular tools. In order to implement the Kaizen approach on a wider scale, they decided to choose the project manager responsible for analysis of the available tools and development of a solution that would meet the company's expectations. As the first element of the project, he organised a workshop with production workers to learn in-depth about their needs. It turned out that some of the solutions that employees proposed to their superiors for implementation on the production line were not implemented due to lack of time to analyse them. This was a kind of waste. To take advantage of this, a suggestion system was developed; within it, each of the employees could describe their improvement proposals. After the Kaizen card was filled in, it was assessed by an experienced maintenance mechanic in terms of the feasibility of a given solution and in terms of profitability. When the solution was not implemented due to low profitability, the person who submitted the given solution always received feedback on the status of their application so that they would not lose the motivation to submit new ideas. This method was referred to by the organisation as a Kaizen suggestion system. In the case of solutions that were implemented, the already functioning PDCA cycle

was used as a process overseeing the planning, execution, verification and collection of the final results of the implementation of a given innovation. The Kaizen card was initially very popular in the organisation. Almost every employee reported at least one improvement that they would have liked to have seen implemented during the year. At one point, some barriers occurred, such as low commitment of top management in appreciating employees for their ideas and a financial barrier that prevented the implementation of all submitted ideas. After this, a reward system for solutions was introduced. The process had been improved and the changes were communicated to all employees. In some cases, the proportion of defective finished products was reduced from 0.9% to 0.4%. In other cases, the replacement of parts of the drive component was saved by 12% due to the self-cleaning solution. The key success factors in the suggestion-system implementation were a focus on production workers and the commitment of top management.

6. Discussion

The Lean tools implemented in the analysed organisation required a high level of employee involvement at the shop-floor level. To do this, high-level managers had to show their commitment to this change and provide appropriate resources, namely, training line employees, purchasing appropriate tools for the implementation of individual solutions (tape, containers, stickers, boards) and being open to employee suggestions. The management board of this company is sure that Lean is a necessary step to improve competitiveness. Brandenburg and Ellinger (Brandenburg, Ellinger, 2020), in their review of human-resource development issues, suggested that companies that want to implement Lean effectively should plan for a proactive organisational learning experience; this was confirmed in the investigated company. The variety of observations, along with literature studies, allow the researchers to conceptualise a model Lean tools implementation, as it is presented in figure 3 below.

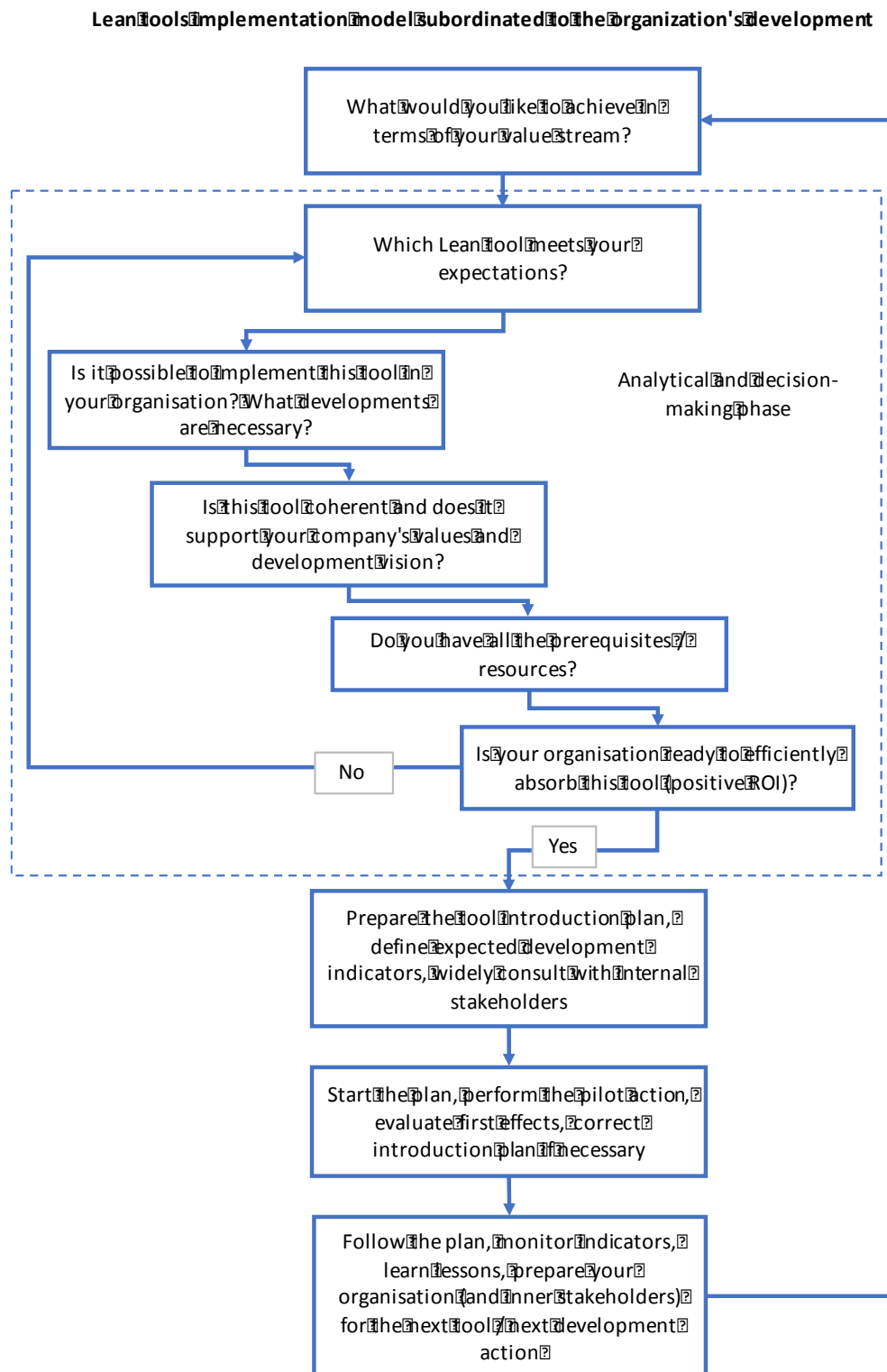


Figure 3. Organizational development driven Lean tools implementation model. Source: own elaboration.

During Lean-method implementation in any company the important issue is always the preparation. Top management should communicate why they decided to do it, what the benefits will be and who will be participating; they should also offer their full support to the project (Safayeni et al., 1991). Figure 3 introduces an approach (algorithm) of how Lean tools have to

be well chosen and implemented. This is a practical approach, subordinated to whole-organisation development. The model starts with business-needs identification; what is fully coherent in the Lean approach needs to be reflected in the value stream. Another set of steps is devoted to comprehensive analysis of the Lean tool that is being considered for implementation (analytical decision-making phase). A very important step is meticulous planning of the introduction, which includes inner-stakeholders' engagement, wide training and a pilot phase. All initiatives should be understood by each employee. After that, in the pilot implementation, the key element is a full focus on engagement and suggestions from employees because this provides essential direction on what should change in any given method to adjust it for the needs of the particular organisation.

A key point during Lean tools implementation is to fully understand the philosophy of the given tool and link it with identified business needs in the organisation. If all employees understand the value of a given tool, it is easier to achieve engagement and create a system that enables a work culture to develop. On the other hand, without understanding Lean philosophy, it is very hard to manage implementation because employees have a problem with believing in the potential benefits. The value stream has to be a first and the only reference point for any changes (improvement) within the organization. So, as it was argued above the Lean tool considered as possibly to be implemented within the organization is valuable as much as it will bring hard benefits in the stream of value. The authors' experiences are that the implementation of a Lean tool needs to be preceded by a rigorous benefits analysis, based on facts as much as it possible on particular stage of organizational Lean maturity.

An additional purpose of the field investigation was to verify the importance of factors of Lean success found in the literature. Interviewees in the company suggested these three main success factors:

1. A real commitment from top management.
2. Targeted and comprehensive communication with all engaged parties and inner stakeholders.
3. Providing encouragement for and actually following line-employee suggestions.

The two first factors above are aligned with top literature key success factors. The third one is identified in fifth position in the literature as a focus on production workers. Employees agreed that the example of attitude and commitment to Lean must come directly from the management of the organisation. Their approach to Lean guides the organisation and sets priorities. The study confirmed to a great extent the observations presented by Lean literature.

7. Conclusions and limitations

It is important that the selected Lean methods implemented in a production company respond to the current problems, challenges and main losses affecting the organisation. If, after implementing the first Lean method, a manufacturing company sees a business effect, it might wonder which method to implement next. As they make Lean decisions, managers should evaluate the impact and capabilities of each Lean method and the difficulties of implementing them in the specific organisational context. This should be based on an in-depth analysis of organisational losses and gains; the voices of experienced managers are of the most importance. At the same time, it is important that these managers understand the possibilities of various Lean principles. Additionally, an important point is to have clear communication about the need for change and the main targets.

The main contribution of this study is that it has enriched knowledge about the practical implementation of Lean tools in manufacturing organisations. It proposes an organisation-development-driven approach to Lean tools implementation. The study suggests that implementation success largely depends on appropriate preparation and adaptation of a tool to the needs of the organisation.

The main limitation of this study comes from the research methodology employed; the case study methodology has been focused on only one research object (company). This company has implemented four Lean tools, and it was confirmed that they had a positive impact on the business results. It is hard to provide accurate business results due to the lack of information about expenses of Lean implementation tools and levels of profit. Future research could use the built-in factor model and guiding questions to verify how the same research will perform in other production companies.

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