Vol. 03, No. 1 (2021) 93-102, doi: 10.24874/PES03.01.009

Proceedings on Engineering Sciences

www.pesjournal.net

APPLICATION OF LEAN TOOLS CASE STUDY IN A TEXTILE COMPANY

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Keywords:

Implementation of Lean; Textile industry; Continuous improvement; Lean thinking; Quality management.

A B S T R A C T

In the Portuguese textile sector, the flexibilization of production activities has become imperative for the adequacy of the response to the progressive increasing complexity of orders for small and highly dispersed lots. Flexibility in production on a case-by-case basis may jeopardize the productivity and competitiveness of businesses. Maximizing productive efficiency by rationalizing resources is at the heart of Lean thinking, which contributes to the definition of business strategies focused on the flow of value to the customer. One of its main objectives is the implementation of continuous improvement, promoting the reduction of costs and waste, while processes are improved and customer satisfaction is increased, thereby increasing income. This paper focuses on a case study, exploring the implementation of Lean tools in a medium-sized textile company. Results show the importance of this methodology in the pursuit for continuous improvement, in the development of organizational communication, as well as in the company productivity.

1. INTRODUCTION

This article reflects an experience with Lean tools and techniques used in a company in the textile sector in the North of Portugal, with the objective of reflecting on the implementation of Lean. The work was developed understanding Lean in an operational and practical perspective, which implies the implementation of certain tools and management techniques to reduce waste (Shah & Ward, 2007).

In this sense, the focus of this article is to consolidate the existing knowledge about Lean, being a starting point for researchers and professionals, who seek to implement Lean tools in organizations, leaving suggestions for future research.

The article is structured as follows: brief allusion to the Lean methodology, its benefits and reference to the main tools used in the implementation of the program; description of the methodological approach used in the case study; contextualization; presentation and analysis of the collected data; presentation and discussion of the results; conclusions and suggestions for future research.

2. IMPLEMENTATION OF LEAN

The textile market has become more and more demanding in terms of delivery deadlines, accuracy and precision of products, which are increasingly complex. To produce goods and services, tailored to the customer, both investment in appropriate technologies and their

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efficient and effective use are essential. Thus, there is a need to change the production process.

Lean management (LM) has been seen as a new paradigm of production processes (Womack & Jones, 2010; Liker & Morgan, 2011) due to its high level of implementation over time. Several researchers have explored the various tools that support its implementation, which have been successfully proven in a wide variety of industries, with many cases of success reported in the literature (Pearce et al., 2018). Based on the literature review undertaken by Nguyen et al. (2017), LM can be considered, according to (Shah & Ward, 2007), from two perspectives, either from a "Lean Thinking" philosophical perspective relating to the guiding principles or general objectives, or from an operational and practical perspective involving the implementation of management tools and techniques to reduce waste.

The tools and techniques used provide productivity gains, fostering continuous quality improvement while minimizing waste (Womack & Jones, 2010; Poduval & Pramod, 2015), reducing production time and defects by promoting effective communication, job satisfaction and team decision-making (Bhamu and Sangwan, 2014). Advantages of implementing Lean tools for small and medium-sized enterprises (SMEs) were identified, i.e. i) promoting the involvement of top management in daily activities, ii) stimulating the implementation of informal structures and cultures, which increase interfunctional relationships, iii) reducing the teams' size, facilitating quick decision making (McAdam, 2000), and iv) increasing the companies' competitiveness, as well as financial strategic advantages in terms of both quality and customer relations (Melton, 2005). The disadvantages identified are linked to a lack of resources and, above all, a lack of training (Koh, Gunasekaran and Cooper 2009). In the literature review undertaken by Kundu and Manohar (2012), the success of Lean implementation depends, according to Scherrer-Rathje et al. (2009): on the commitment of top management and its involvement in the Lean effort; on the autonomy of employees to make decisions about changes in business processes; on the transparency of information about Lean objectives; and on the evidence of initial performance improvements and the long-term sustainability of Lean efforts. More broadly, as Bhamu and Sangwan (2014) state, the success of the LM depends on the prevailing work culture and practices in the organization, which is aligned with Czabke et al. (2008), who considers of great importance to communicate the vision of the new initiative, at all organizational levels, to tackle the necessary change in the organizational culture and, consequently, follow new practices and principles.

Among the tools usually associated with the implementation of the LM are, for example, Kaizen, Kanban, the 5S program, SMED (Single Minute Exchange of Die), Total Quality Management (TQM) (Herron and Braiden 2006).

Kaizen introduces the idea of continuous improvement, based on the principle of reducing or eliminating waste and activities that do not add value. It aims to improve productivity, reduce waste, eliminate unnecessary effort and humanize the workplace. According to Liker (2004), Kaizen is effective in identifying waste ("muda"), overload ("muri"), and inequality ("mura") and is, therefore, the natural key to long-term success (Tan Ching Ng. & Morteza Ghobakhloo, 2018) and is considered the main axis of LM thinking. Its implementation does not depend on large investments and involves the gradual introduction of small adjustments in processes and working methods.

Kanban means "sign or notice board" and proposes the use of cards on a board, so that, with the least allocation of resources, it is possible to indicate and monitor the progress of production flows, in a visual and practical way.

5S is an appropriate tool for the introduction of change in the employees' attitudes, i.e. to encourage their involvement in workplace improvement activities (Gapp et al., 2008). The designation 5S has its origin in the first letter of five Japanese terms: Seiri, Seiton, Seiso, Seiketsu, Shitsuke (Ishikawa, 1986). Its application involves: classifying or separating (removing from the workplace everything that is not used daily); sorting or defining (arranging the tools used daily to facilitate access); cleaning or caring (cleaning and caring for the work space); standardizing (developing procedures to ensure compliance with the program) and sustaining or maintaining (motivating and committing to daily compliance with the procedures).

The implementation of the 5S program can provide the following results: elimination of the storage of intermediate products and unnecessary documents; improvement in internal communication, control and organization of documents, use of space, comfort and convenience of the visual space of the areas and the working environment in general, of the definition of the layout, of the standardization of procedures, as well as the time and effort spent in the execution of tasks and the involvement and delegation of powers (Marshall Jr., 2007).

5S is one of the most appropriate methodologies for continuous improvement processes, especially because it provides immediate results to its application (Bayo-Moriones et al., 2010) and because it is closely linked to Kaizen-related activities (Imai, 1989).

SMED is one of several Lean production methods to reduce production waste. According to Godinho Filho and Fernandes (2004), small batch production and stock reduction are an incentive to implement the system tool for the reduction of changeover time (SMED). Shingo (1985) distinguishes three stages for the development of this methodology: i) identification and classification of

both the internal setup, defined as the set of activities performed with the machine stopped, as well as the external one, i.e. i) the set of operations performed with the machine in operation; ii) the verification of the operations allocated to the internal setup, which can be converted to the external setup; and iii) the systematic improvement of each operation of the internal and external setup. The definition of the last stage results in the association of the SMED with continuous improvement. The first two stages are interdependent and can be analyzed together and, according to Shingo (1985), the methodology involves a sequentially established conceptual phase and the application of techniques resulting from this phase, but other phases have been suggested with the purpose of improving the methodology (Moxham and Greatbanks, 2001). In general, setup time is considered as the preparation time, necessary to start the production of a new product, but it is sometimes confused with indexing time, which is the time necessary to change tools and, therefore, of less magnitude than the total processing time (Patel et al., 2001). The time needed for the setup has a direct relation with the similarity between the successive tasks processed on the same machine; moreover, if two sequential tasks are similar, the setup time between the first and the second is proportionally inferior to what would be necessary, if the consecutive tasks were very different. Consequently, the benefits collected by the SMED can be minimized, if planning is random (Sugai et al., 2007).

The adoption of Lean thinking entails a change of culture on the part of the organization, introducing organizational changes that alter the day-to-day running of the company (Werkema, 2012). Of the various factors that affect the quality of management performance, the human factor is the one that has the greatest impact, either through the employees' skills or through the commitment of top management (Pinto, 2008; Mendonça et al., 2011); therefore, it is one of the main critical factors for the success of the project implementation. By providing a favourable environment for people's involvement, maintaining a continuous focus on the client's needs and expectations, the contribution of Lean, in the context of quality management, is now recognized as vital to the organizations' behaviour, since strategic planning stimulates and maintains the competitive factors through a rigorous global alignment of the processes (Pinto & Pinto, 2011).

By facilitating and stimulating the sharing of errors and corrective measures by all stakeholders, avoiding unnecessary repetitions of failures and contributing to a more consistent organizational knowledge, internal communication also becomes an increasingly differentiating element in the organizations' competitiveness, which manifests itself in the corporate culture for performance management. By promoting employee participation in work teams, team problem solving, constant evaluation of results and relationships with suppliers, quality leveraged in Lean thinking can be considered both as an integrated management philosophy and a set of practices that emphasize continuous improvement, alignment with customer requirements and reduction of work repetition. Globalization and competitiveness have driven the transformation of businesses according to the ideals of Lean leveraged quality and the implementation of these strategies provides the change of the organizational culture and the awareness of customer perspectives.

In the recent past, quality management has been used as a means of responding to crises, and both the implementation and certification of quality management systems have been instruments for gaining competitive advantages for the textile and clothing industry (Ramos, 2004); nowadays, the use of Lean-based quality can be seen as a way to improve the production systems of national SMEs, particularly in the textile sector.

3. METHOD

The methodology of this study is qualitative, using case study design (Yin, 2009). It consists of an interpretative approach in the sense of understanding the processes, the products, the phenomena implied in the whole theme involved in this research. The case study is used in exploratory and descriptive and explanatory research. It is grounded in the understanding of the complex interactions of the organizations functioning, mainly to understand how a certain internal process of a company occurs (Godoy, 2006).

An Action-Research methodology (O'Brien, 2001) was used, which translates into the involvement of the company employees, making them the agents of change in problem solving and in the application of Lean tools. This method defends a logic of learning by doing and is embodied in a spiral process (Saunders, Lewis and Thornhill, 2009, p. 148) that aims to optimize the performance of the organization under study (O'Brien, 2001; Carr and Kemmis, 2004; Maklan et al., 2008). The research strategy substantiated in the examination of a phenomenon in its natural context and the data was collected from multiple sources (managers, middle managers and collaborators) and was focused on a contemporary event. It is considered to be a holistic approach.

3.1 Procedures

The work was divided into 5 stages, as illustrated in figure 1. Thus, the diagnostic phase consists in collecting and analyzing data to identify waste; the planning phase covers the analysis and discussion of the best Lean tools to be used in the different cases, as well as planning the actions to be undertaken; the implementation of the actions developed; the evaluation of the results obtained; and, finally, the learning phase, in which the results

obtained and their impact on the organization are recorded (Kuhne & Quigley, 1997).

Lean thinking has an open structure that allows individual selection and alignment of methods according to the specific needs and circumstances of the organization. The use of methods requires a continuous review of efficiency and modification, if necessary. It is now known that the isolated use of methods practiced at the early start of the adaptation of Toyota Production System (TPS) methods does not lead to the desired increase in efficiency (Shingo, 1985).

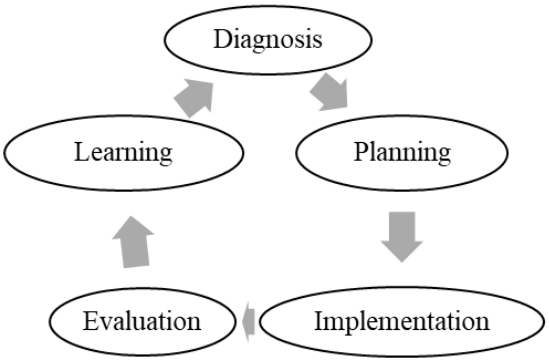

Figure 1. The 5 phases of the research-action methodology

In this sense, the development of the present work required the following phases: a) preparing an organisational diagnosis; b) conducting semi-structured interviews with top management; c) undertaking a SWOT analysis; d) setting up multifunctional teams with employees and assigning the respective coordination; e) providing specific training to the teams on Lean tools and practices; f) assigning responsibility for the implementation of specific measures by each team; g) holding periodic meetings. The objectives of the periodic meetings were focused on: finding out the state of affairs, using checklists, videos, photographs, interviews; discussing and debating the objectives to be achieved; drawing up the plan of actions to reach the improvements to be achieved; implementing the actions; and evaluating the results of the actions implemented.

For a better perception of the results obtained at the end of the implementation of all the actions and aiming to making a final balance, the initial state and that achieved with the application of this methodology investigation-action were compared against. For this purpose, na inquiry was carried out, based on a questionnaire using a five-level Likert scale per parameter or item: a) abbreviated waiting times for production orders; b) organization of the work station; c) abbreviated setup time of the machines; d) reduced quantity of stocks and e) internal communication.

4. CONTEXT OF THE CASE STUDY

The company under study is firmly established and is a reference in the textile sector in Portugal. It was created in 1986, on the initiative of its founders who had professional experience in the area, in the form of a private limited company. It currently has about 80 employees and is dedicated to knitting knitwear on 80 circular looms. Due to its continuous growth, in 2000, it became a public limited company 2001, it implemented the Quality Management System ISO 9001:2000, having been certified according to this standard from 2001 to 2005. Due to market demand, in 2003, it certified its products according to the OEKO-TEX® STANDARD 100 system (which guarantees the exemption of harmful products to human health) and, in 2014, it obtained the GOTS certification (Global Organic Textile Standard – a standard that guarantees to the consumer that their clothes are produced with environmentally and health-friendly chemicals in factories that respect fair social criteria).

The company has strong and privileged relationships with its customers, consolidated by its ability to meet specifications and delivery times, as well as the offer of products with a very competitive price/quality binomial.

These are the reasons that lead to a very loyal and diversified customer portfolio. In order to maintain this customer portfolio, the company invests in the development of its physical and technological infrastructures, as well as in the improvement of its management models.

An interview with top management was used to understand the company's strategic objectives, summarized in table 1.

Table 1. Strategic objectives of the company

	Current situation	**Desired situation**
Target market and internationalization	Good portfolio of national clients	Keep the client portfolio
Product range	Production of almost all types of knitwear requested by customers	Monitoring the modernization of the sector in order to satisfy its customers
Organization, management and information systems	IT organization of the planning, production, warehousing and invoicing sectors	Improved integration of these programmes Improvement of interdepartmental communication
Technology and production	Need to reformulate production planning and scheduling processes	Improvement of procedures and implementation of Lean thinking

The company's infrastructure was adequate or good. However, there was a clear need to reorganise spaces, particularly in terms of warehouses. Due to the gradual increase in the number of machines, there was also a need to reorganise the spaces within each workstation. In terms of planning and production management, the need for adjustments was identified, due to the decrease in orders and diversification of samples, which led to an increase in unproductive times for machine tuning. The increase in the diversity of raw materials and small stock rotation highlighted the need for a study dedicated to logistics and stock management issues, as well as to the reorganisation of warehouse space.

In order to characterize the (internal and external) risks and opportunities to be considered in the plan of measures to be implemented, a SWOT analysis of the company was prepared (table 2).

Table 2. SWOT analysis

Strengths	**Weaknesses**
Product quality Ease of collection Reference name in the market	Lack of interdepartmental communication Lack of definition of payment terms with new customers Lack of space High stocks
Opportunities	**Threats**
SME support programs Contracting incentives	Competition High energy costs

This analysis showed that there was a good client portfolio and a good financial situation. There was evidence of the market's recognition of the company and the willingness to improve production performance through improved interdepartmental communication and the introduction of new management methodologies.

In view of this situation and to promote the company's productivity, it was decided to implement some methodologies associated with Lean. This option was based on the need to make the company more flexible and to facilitate its adaptation to the constant changes in the markets, in order to guarantee the customer satisfaction. While the size of production batches is continuously decreasing, both the diversity of materials and the level of requirements in terms of quality/price/delivery deadlines are continuously increasing, making the production sector increasingly complex and, simultaneously, more challenging.

The work developed counted on the participation and involvement of the company's employees, distributed in 6 working groups with 8 elements each. The process began with the development of training actions for employees on Lean thinking, in order to provide them with adequate knowledge about the methodologies to be implemented in the intended approach.

Initially, using a methodology based on Lean thinking, a survey of the largest wastes, non value-adding actions to the product, namely, waiting times, movements and storage conditions was undertaken.

During the process, other gaps were also detected, such as the lack of communication between the different sectors, the disorganization of workstations and the need for improvement in the collection and sorting of waste within the industrial plant. Based on this survey, the following measures were then proposed:

1) Adjustments to production planning and scheduling processes;
2) Reorganization of the workstation;
3) Decrease of the loom setup times;
4) Implementation of visual management in planning and production;
5) Identification and elimination of unnecessary transportation and movements;
6) Reduction and reorganization of raw material stocks.

5. PRESENTATION OF DATA AND PROPOSALS FOR IMPROVEMENT

In this section, the implementation of some tools and strategies used in the work developed, and which was based on Lean thinking, are presented. The data obtained with the different groups will also be presented.

5.1 Adjustments to production planning and scheduling processes

At the diagnostic stage, a communication deficiency between the planning/finishing/production departments and warehouses, associated with errors and delays in production, was found.

After the analysis of the planning and production procedures, and through the comparative analysis of the documentation used and the documentation necessary for the control of the production process, some changes were found to be necessary.

The result of this inquiry was:

- Change in the planning and production software. The 'next day's tuning' orders started to be prepared in computerized form and not in paper form, as it had been until then; thus

making the information available to all those involved in the production process;
- Optimization of the use of computer support. This was achieved by fully replacing the wiring, improving and by widening the network signal to the entire production area, creating an intranet and reviewing the entire IT equipment;
- Changing the location of the yarn guide listing workstation. This workstation was moved to the warehouse in order to speed up the process.

In the context of this measure, a production and distribution plan was also prepared aiming to improve communication with customers and, at the same time, lighten the order intake process in production.

5.2 Organization of the workplace

The dissatisfaction expressed by everyone (managers and workers) regarding the organization, cleanliness, conservation and tidiness of the workstations suggested the implementation of the 5S methodology. For the implementation of this measure, some supporting tools were developed, such as: a) 5S implementation plan; b) employee performance evaluation sheet; c) work instructions for cleaning the looms; d) welcome manual and e) good practices manual. An action plan and a needs evaluation for cleaning material and repairs, to be carried out in the industrial premises, were also prepared.

Finally, the criteria to be used in the performance evaluation were discussed and analyzed.

This entire process was reflected in the improvement of the working environment, as well as in the general motivation of the company's employees.

5.3 Reduction of setup time

The reduction in size of the production batches and the wide variety of materials and products, result in an increasing number of loom tunings, thus increasing unproductive times. This reality poses the challenge of making production more flexible.

To achieve production flexibility, it was necessary to lighten procedures, thus obtaining time gains in the preparation and tuning of equipment. To accomplish this, the entire production process was analyzed through the elaboration and visualization of a video to detect the existence of dead times and unnecessary movements. To optimize the activities, after consulting the tuning datasheets, the tools were defined, improving both the transportation and the information processing, which is now supported by checklists.

The new procedure to prepare the looms was defined based on the use of machine cards ready for tuning, placed in a frame strategically positioned for immediate viewing. This new procedure has improved understanding between teams and reduced waiting time owing to communication failure.

5.4 Implementation of visual management in planning and production

The lack or failure of communication was one of the main shortcomings detected during the initial diagnosis in the company. To fill in this gap, the use of visual management was an effective tool, not increasing administrative work. In this sense, the measures encompassed:
- the introduction of production tables, in areas where the work orders planned for the day are displayed;
- the implementation of a "machine ready for tuning" table;
- the production of the respective cards;
- the identification of no-use areas for mobile phones;
- the identification of storage and warehousing areas for the maintenance of the organization of the factory space.

5.5 Identification and elimination of unnecessary transport and movement

The acquisition and implementation of new looms resulted in the limitation of manufacturing space, which was reflected in the appearance of additional difficulties in the movement of both raw materials and products for storage. To overcome these constraints, it was necessary to reorganize and/or release new spaces, thus, reducing or eliminating tasks with no added value to the product. The following measures were implemented:
- to release the space used for intermediate storage (next to the machinery), a system of pallets was implemented, to place the yarn to be returned to the warehouse using sign cards. This way, the warehouse employees started to access, in an agile way, the information about the existence of yarn to store, avoiding to wait for the delivery of the list given by the shift manager, saving space, time and unnecessary movements;
- A new space was reserved for the yarn winding, freeing up space for the placement of material awaiting production and avoiding contamination;
- To reduce the time spent with tasks with no added value, the use of duplicate guides was implemented for the yarns of service subcontractors so that, when returned, the surpluses are properly identified and promptly placed in their respective places.

5.6 Reduction and reorganization of raw material stocks

In the weaving industry, over the last few years there has been a significant increase in yarns with different characteristics, compositions, titles, etc. Therefore, the number of different items stored has also increased exponentially. Some suppliers belong to the foreign market and their delivery times are extended, which requires higher security stocks. The markets situation also leads to an increase of stock, in warehouse, to take advantage of promotions. This scenario has resulted in a warehouse with low stock turnover and shortage of space for proper and adequate storage.

In order to make a better use of the existing space, an analysis of raw and dyed yarn inventories was carried out. An ABC classification of the different items was undertaken and a study concerning the warehouse reorganization was started, which translated into dividing the space into different areas.

In an attempt to increase the storage space, unreferenced yarns and those not used in recent years were identified and eliminated. A maintenance plan of the forklift trucks was also prepared.

5.7 Selective waste collection in the company

To reduce the space occupied by the waste and to reduce the time of its handling, specific containers to sort the waste were placed in strategic areas of the company, thus, improve its conditioning.

The selective collection of cardboard tare was also reorganized, for later return and reduction of its separation time.

5.8 Implementation of a dining room

As afore mentioned, one of the main problems of this company is the lack of communication between employees.

In order to improve communication among employees and social interaction within the company, it was decided, together with top management, to create a dining room. Thus, it was possible to improve the conditions of the facilities to accommodate its employees. This room was equipped with a sink and microwave oven to facilitate the consumption of hot meals.

An event communication board and a suggestion box were also installed.

6. ANALYSIS AND DISCUSSION OF THE RESULTS

After implementing of the measures presented, and after the appropriate lapse of time, the working groups analyzed the impact of these measures and found that:

- With regard to adjustments to production planning and scheduling processes, machine downtimes were reduced due to a faster flow of information and also to a reduction in order waiting time for production. There was also a reduction in delays caused by communication failures (Alpenberg & Scarbrough, 2016). There were benefits both in internal communication and in the production and organization system by reducing costs through the elimination of waste (Shah & Ward, 2003; Melton, 2005; Liker & Morgan, 2011).
- In the organization of workstations, with the implementation of the 5S methodology, there was an improvement in the cleanliness, tidiness and neatness of the facilities, resulting in the reduction of internal and external complaints regarding dirt and contamination (Gapp et al., 2008; Poduval & Pramod, 2015).
- Through SMED implementation, a reduction in loom setup times was achieved, enabling equipment to become more flexible and profitable (Moreira & Pais, 2011; Ibrahim et al., 2015). There was a reduction of machine downtimes, which resulted from communication failure between parties. Information archive on machine tuning was also improved.
- The use of visual management, in planning and production, has improved the information flow within the company, with the consequent reduction of errors, waiting time and the agility of procedures and processes.
- The identification and elimination of unnecessary transportation and movements, optimized the traffic to and from the warehouse; allowed for the reduction of intermediate storage, creating spaces that enabled the movement and cleaning of the spaces near the machines; reduced waiting time caused by the failure of communication within sectors, as well as the time use to sort and identify yarn for warehousing.
- The reduction and reorganization of raw material stocks has allowed for an increase in free space in the warehouse. The improvement and identification of the areas has diminished the movements within the warehouse, the errors of identification and the time spent moving the yarn. Consequently, there was an increase in the efficiency of the productive sector and warehouses, in line with Herron and Braiden, (2006).

- The selective collection of waste in the company has allowed for the optimization of its collection and conditioning, as well as the sorting of the cardboard tare (to be returned to suppliers); thus, reducing the time dedicated to these tasks.
- Finally, the creation of a dining room improved social interaction among the company's employees, with all the positive consequences it entails.

All these enhancements also enabled an increase in product quality and productivity, thus allowing the company to become more competitive (Agis et al., 2010). The results obtained from the employee questionnaire provided evidence as to an improvement in every parameter that was the intervened throughout the period of implementation of this action-research methodology (abbreviated waiting times for production orders, organization of the workstations, shortened time for machine setup, reduction of stocks and enhancement of internal communication).

However, as shown in the radar graph below (figure 2), the parameter of internal communication was the most benefited, according to the employees' perception. The observation of this graph also reveals considerable benefits in terms of the organization of the workplace and the reduction of both setup and waiting times. The level of stocks was, apparently, the parameter that least benefited from this intervention.

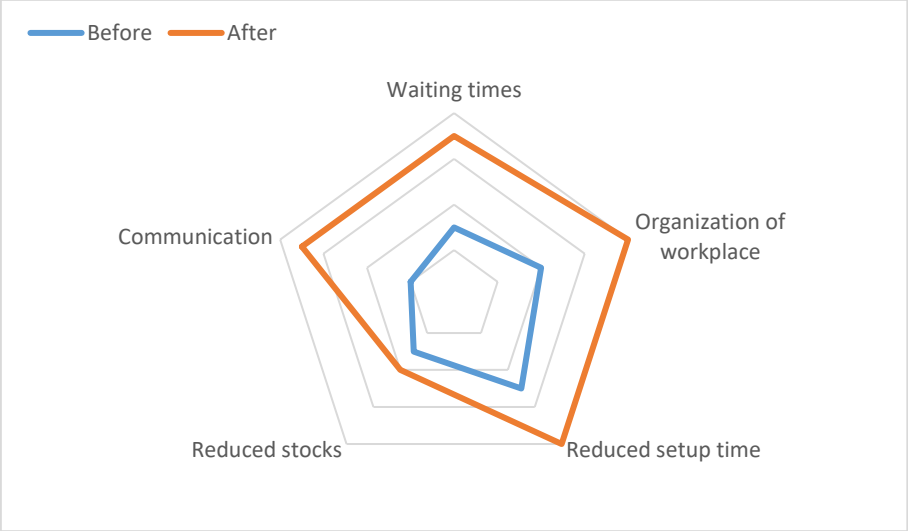

Figure 2. Evaluation of the impact of the measures by employees

On the one hand, the improvement in communication probably resulted from the implementation of the visual management system. On the other hand, the creation of a space shared by all employees (dining room) also fostered new dynamics among them, resulting in information sharing. The improvement in communication may have had an impact on other parameters, contributing, for example, to a substantial reduction in waiting times for production orders.

The reduction in the raw material stock was not so pronounced, since management invests the assets in the purchase of seasonal low price materials. However, the reorganization of the warehouse, resulting from the 5S program, was undoubtedly beneficial and provided the opportunity to eliminate obsolete and discontinued stocks.

7. CONCLUSION

The implementation of the lean approach, as well as the tools it implies, in the target company of this study, allowed to prove several aspects pointed out in the literature.

First of all, we would like to stress that the use of the various tools has enabled changes in the company, namely through an increase in the efficiency of the production sector and warehouses, improved cleanliness and space release, and more effective communication between the various sectors and hierarchies. These changes have created productive and economic benefits, which have been felt from the outset, highlighting: the reduction of time spent searching for materials, the reduction of errors in production, the reduction of downtime with the consequent gain in productivity. Thus, the elimination or reduction of waste was promoted, having also been possible the increase of the product quality and the increase of productivity, rendering the company more competitive.

It should also be highlighted that the 5S program has proved to be an adequate tool to introduce changes in employee behavior, encouraging their engagement in workplace improvement activities.

It is important to stress that through the involvement of all employees and managers in this process, communication barriers have been broken down, which

has translated into increased motivation and improved social interaction with all the benefits that arise from it.

Thus, this model provides clear benefits to the companies that implement it at the level of both the internal communication flow and the production and organization system, through the reduction of costs by eliminating waste. Moreover, it adds competitive advantages to SMEs and can be considered one of the most effective tools to be implemented.

This study presents as limitation the direct consequence of the method used – case study –, i.e. the conclusions and recommendations presented refer to the reality of the organization studied and cannot be generalized. Nevertheless, a positive point is the possibility of carrying out other studies on the same subject in other organizations with this one as a robust starting point.

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