POSSIBILITIES OF USING THE LEAN STRATEGY TO OPTIMIZE PRINTING PRODUCTION

Lucia ADĂSCĂLIȚA[1], Miron ZAPCIU[2], Emilia BĂLAN[3]

Rezumat. *În contextul globalizării pieței, când soluția supraviețuirii este creșterea competitivității, aplicarea principiilor și instrumentelor Lean Manufacturing este tocmai potrivită dat fiind faptul că acestea asigură și disponibilitatea resurselor necesare dezvoltării. În această ordine de idei, înainte de aplicarea nemijlocită a sistemului Lean în cadrul unei tipografii, este necesară cunoașterea situației existente care va permite determinarea priorităților de acțiune. Lucrarea prezintă rezultatele analizei diverselor experiențe de implementare a strategiei Lean în cadrul tipografiilor din întreaga lume care a favorizat identificarea celor mai bune practici și a celor mai eficiente instrumente Lean pentru producția poligrafică. Sunt identificate și prezentate etapele specifice procesului de implementare a strategiei Lean în cadru întreprinderilor tipografice. În context, sunt identificate, descrise și analizate oportunitățile și amenințările în acest sens.*

Abstract. *In the context of market globalization, when the solution to survival is to increase competitiveness, the application of the principles and tools of Lean Manufacturing is just right given that they also ensure the availability of resources needed for development. In this regard, before proceeding to the direct application of the Lean system in a printing house, it is necessary to know the existing situation that will allow the determination of priorities for action. The paper presents the results of the analysis of various experiences of implementing the Lean strategy in printing houses around the world that favored the identification of best practices and the most effective Lean tools for printing production. The specific stages of the implementation process of the Lean strategy within the printing enterprises are identified and presented. In this context, opportunities and threats in this regard are identified, described and analyzed.*

Keywords: printing, paper bags, optimization, Lean manufacturing.

1. Introduction

Lean Manufacturing has often been considered applicable only to manufacturing industries, but as J.P. Womack, D.T. Jones and D. Ross said in their first literature on Lean [1], „The machine that changed the world", this concept is applicable to any industry. In the last two decades, more and more printing companies have

[1]PhD Student, Eng., Doctoral School of Industrial Engineering and Robotics, University POLITEHNICA of Bucharest, Romania (E-mail: lucia.adascalita@dtp.utm.ro).
[2]Prof., PhD Eng., Faculty of Industrial Engineering and Robotics, Robots and Production Systems Department, University POLITEHNICA of Bucharest, Romania, corresponding member of Academy of Romanian Scientists, (E-mail: miron.zapciu@upb.ro).
[3]Assoc. Prof., PhD Eng., Faculty of Industrial Engineering and Robotics, Robots and Production Systems Department, University POLITEHNICA of Bucharest, Romania, (E-mail: emilia.balan59@yahoo.com).

introduced and implemented elements of Lean Manufacturing [2]. Lean Manufacturing can help printing companies do more with less resources and reduce their costs by reducing the number of value-added activities. Lean is focused on doing the right things, at the right place and at the right time, throughout every step from product development, supply and manufacturing to distribution [3], [4]. It should be noted that the Lean production system is "all-encompassing, which means that employees must also commit to the success of its implementation" [5].

The printing industry is based on fierce competition, where every company in the field tends to offer customers the finished product in the shortest possible time and with minimum costs. In other words, these companies tend to react as quickly as possible to customer demand and work with minimal expenses possible. These aspects are sometimes difficult to achieve due to inefficient activities, but also due to the multitude and diversity of technological operations specific to the manufacturing flow. These, in turn, are influenced by the human factor, environment, materials and equipment.

In this regard, before the direct application of the Lean system in a printing company, in this case, focused on the production of paper bags, it is necessary to know the defining aspects related to this concept, its own principles and tools, the methods of application, as well as the existing situation that will allow the determination of priorities for action. Finally, by performing the SWOT analysis, the strengths and weaknesses that are indispensable in the initial phase will be identified.

2. Theoretical aspects

Lean Manufacturing is a management system for the activities of companies based on manufacturing operations whose result is „a product manufactured better, more, and with less" [6].

Since the first appearance and implementation of the Lean concept, it has undergone changes over the years. Fig. 1 shows this evolution.

Fig. 1. The evolution of the Lean concept.

In general, manufacturing activities can be divided into three categories, according to the value with which they contribute to the manufacture of the product: value-added activities, ancillary activities and inefficient activities (Fig. 2).

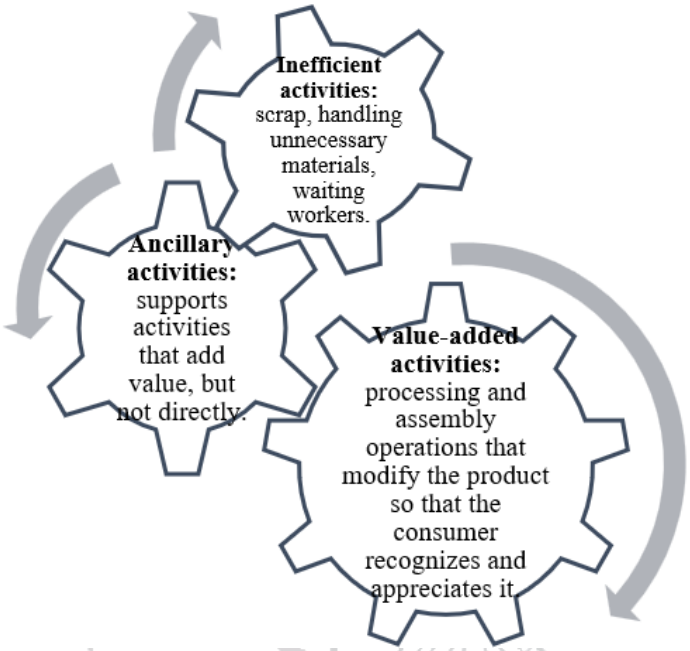

Fig. 2. Categories of manufacturing activities (adapted from [5]).

The Lean production system works by eliminating inefficient activities so that only value-bearing and ancillary activities are performed, ie they come to improve the performance of companies. Thus, with the development and spread of the Lean philosophy, numerous tools were involved that ensured continuous improvement. It should be noted that all Lean tools, now known, have appeared in certain situations as a result of practical solutions found by certain companies. Some of them have appeared in different fields and periods under different names, but which are similar in principle and stages of implementation. Fig. 3 shows some of the Lean tools.

In the case of the printing industry, the diversity of products is enormous: periodic products (magazines, newspapers), non-periodic products (books - in wide range) and products such as packaging, labels, leaflets, flyers, panels, banners, etc. In Fig. 4 is presented the structural-functional manufacturing model in the printing field. Since the manufacturing process is associated with the product, printing companies must opt for Lean management and aim to implement a specific tool or tools to improve efficiency, enhance performance and ensure continuous improvement.

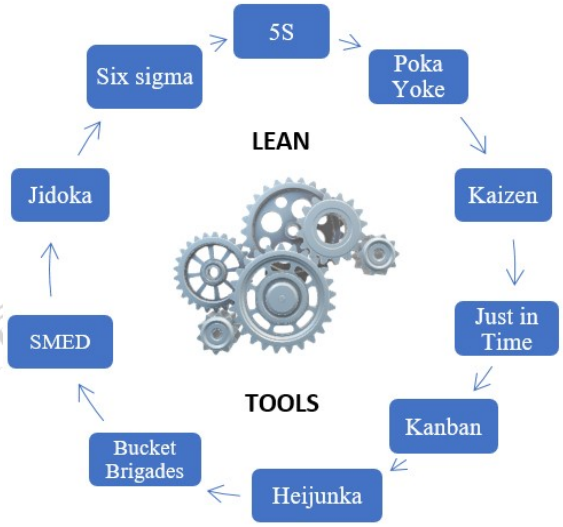

Fig. 3. Lean tools [7], [8].

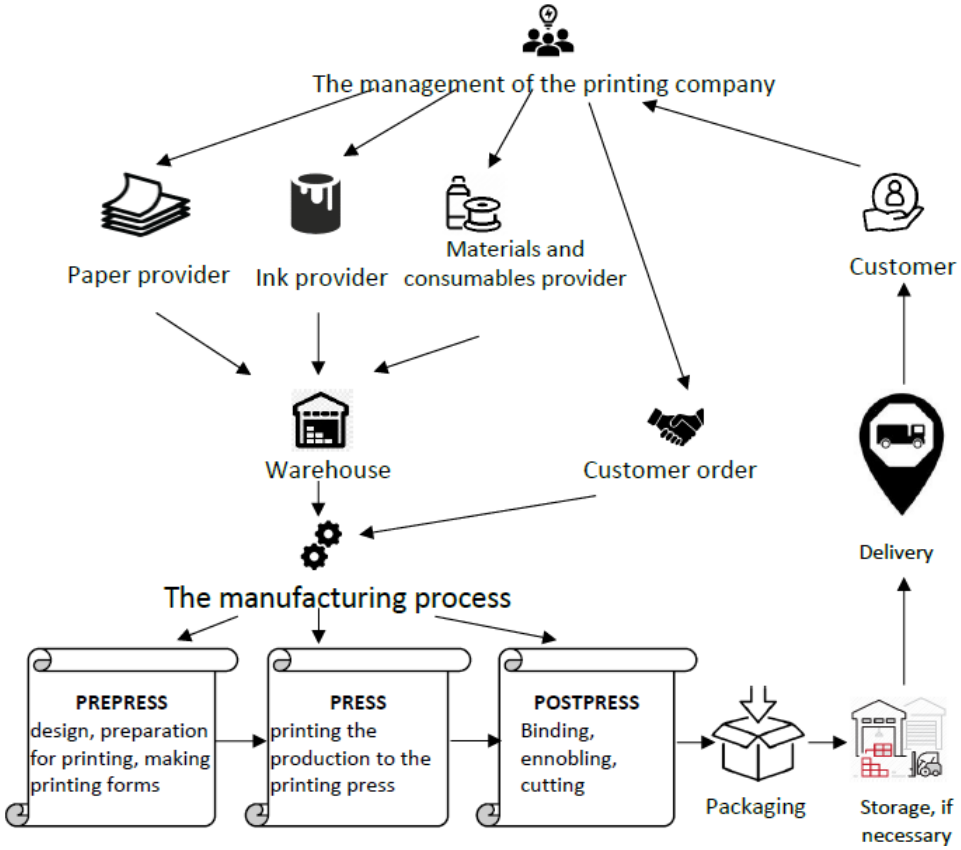

Fig. 4. Structural-functional manufacturing model in the printing field.

3. Methodology and current status

This paper proposes qualitative and quantitative interfaces, involving in order to elucidate them, research methods such as: observation, information processing, case study and SWOT analysis. In this sense, the good practices of implementing various Lean tools in printing houses in countries such as: Romania, USA, Malaysia, Indonesia, India, Russia were analyzed. The activity related to these cases involves the comparative analysis, but also the identification of the specific cases of each country.

At the same time, the study focused on the collection and systematization of data on waste caused by inefficient activities specific to the analyzed company, which does not add any value to the printing product, from the customer's point of view. Attention was paid to waste related to manufacturing time, labor productivity, defects, materials and consumables, use of printing equipment and space.

In order to satisfy the end user, printing companies in different countries adopt a wide variety of tools, including Lean tools, to improve the efficiency and quality of activities. As a result of the observation and processing of information, Table 1 was made where the aspects specific to the adoption of certain Lean tools in printing companies in Romania, USA, Indonesia, Malaysia, India, Russia are systematized.

This is proved by multiple results of the research activity, published in this regard [3], [6], [9...13]. Knowledge of these data and aspects of good practice in different parts of the world can essentially contribute to the safe choice of the most suitable, for printing companies, Lean tools.

Table 1. Lean tools implemented in printing houses in different countries

No.	*Lean tools*	*Country where Lean tools are implemented*					
		România	Indonesia	Malaysia	India	Russia	USA
1.	Kaizen	+					+
2.	Just in Times	+				+	+
3.	5S	+	+	+	+	+	+
4.	Six Sigma		+		+	+	+
5.	SMED	+	+	+			

Thus, it is found that the most frequently adopted Lean tools by printing companies are Six Sigma, 5S, SMED and sometimes Just in Times and Kaizen.

The fact that printing companies opt for the 5S and Six sigma tools is explained by the fact that they are easier to sustain in the long run and as an implementation methodology they are closer to the specifics of the printing industry. The 5S tool involves improving and maintaining the results of improvement, and Six Sigma - systemically improving processes by eliminating non-conformities [8].

It is observed, in many cases, that the steps necessary to implement a Lean tools involve the direct involvement of at least one more Lean tools. For example, adopting the SMED or Six Sigma tool also uses the 5S method to improve the process, or to monitor the results obtained [3], [9], [10], [11], [14]. At the same time, the involvement of analysis tools such as: Pareto diagram, Ishikawa diagram, 5 why, Value Stream Mapping.

From the analysis performed, it was found that some printing companies in Romania opt and have even implemented the 5S tool for a better organization of the manufacturing process, the efficient use of spaces as well as the modification of working methods. The success of Sunimport Rottaprint Cluj, a company specializing in flexographic printing, which implemented the Kaizen tool, is noteworthy. By following the steps, the company managed to increase the labor productivity of printing machines by 25%, while improving the downtime of machines and unnecessary movements of printers by 64% [13]. For the successful implementation of the company Sunimport Rottaprint Cluj was awarded, in 2015, the Kaizen Romania award [15].

4. Case study

The case study concerns the activity of a printing company in the Republic of Moldova that annually produces 10 million paper bags, various in shape and size (Fig. 5). They are marketed both internally and externally.

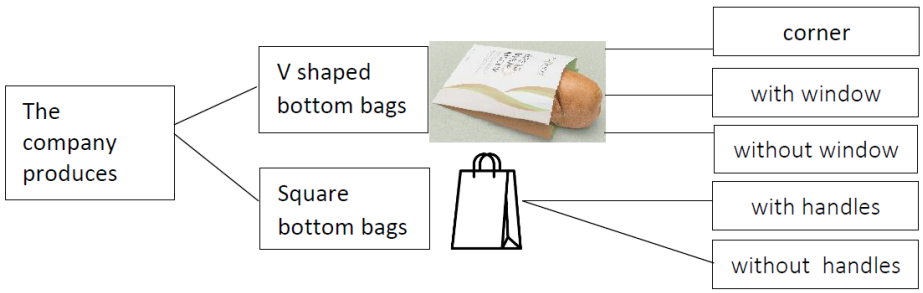

Fig. 5. Types of bags made by the company.

This company, in 2014, implemented the quality management system ISO 9001: 2008, and in 2017 the system was improved to ISO 9001: 2015. An important part of its strategy is to manufacture products in a safe working environment that does not harm nature and human health. In this context, in 2019, the company was FSC-CoC certified.

The company producing paper bags, since 2020, aims to optimize and improve the existing production system by involving one of the Lean tools, for which an initial analysis was initiated. For a better understanding of the situation, Fig. 6 shows the production flow of the company.

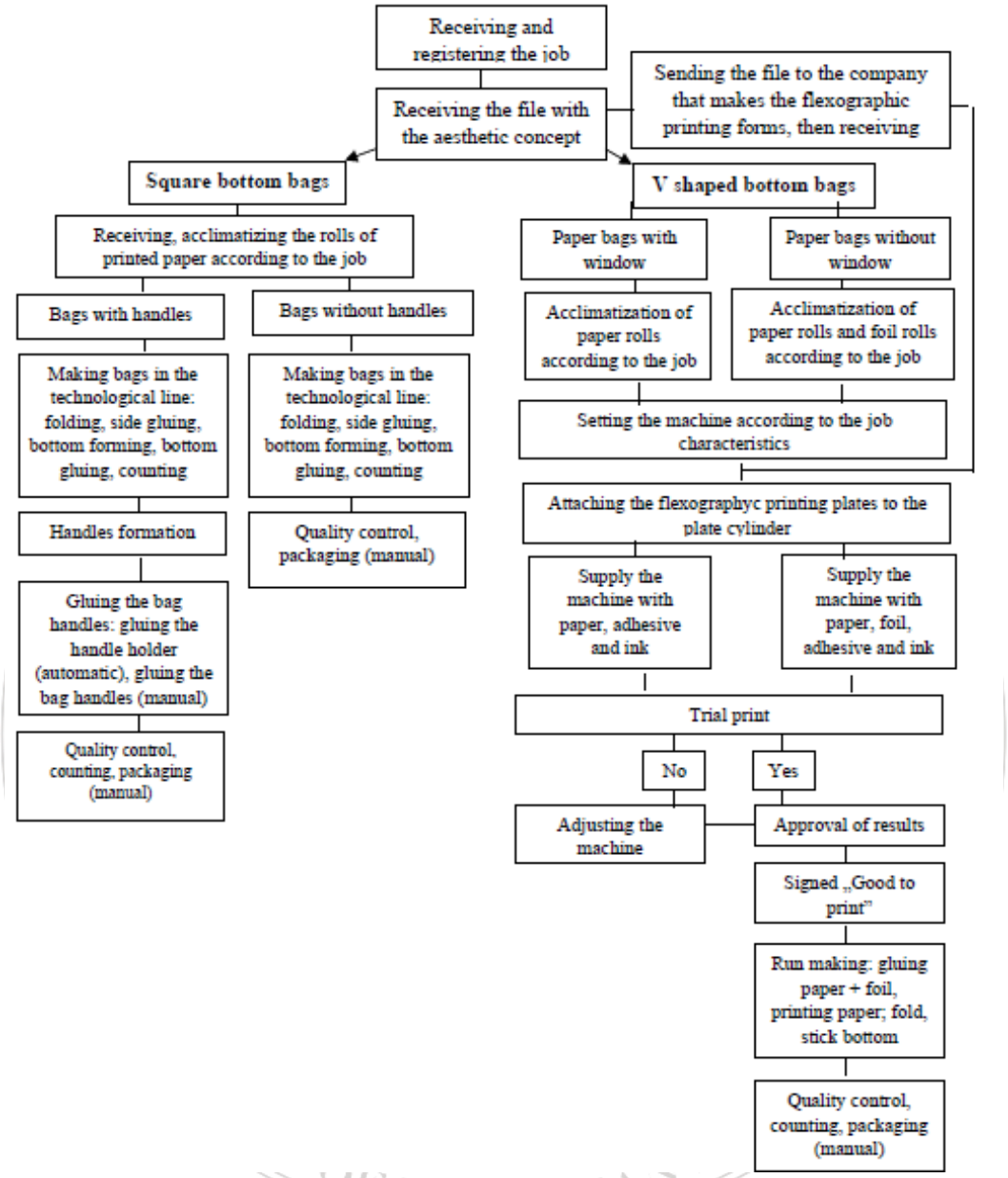

Fig. 6. The production flow of paper bags within the studied company.

At this stage, the objective was to examine the specific aspects of the production environment in order to establish strengths and weaknesses, an analysis that will provide the possibility to establish milestones to ensure the expected performance by adapting the Lean production system (Fig. 7).

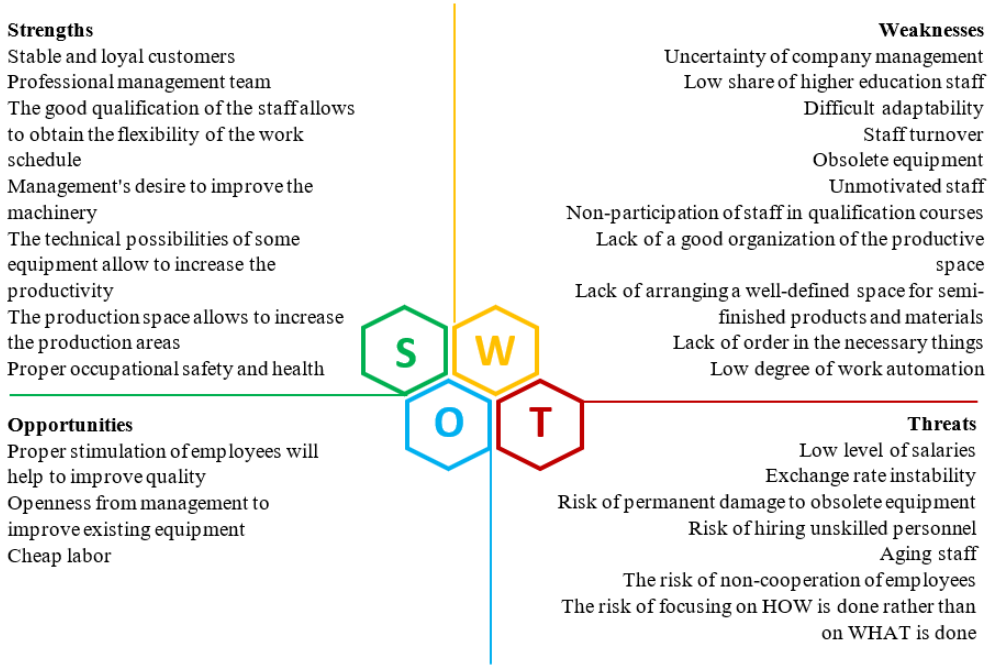

Fig. 7. The SWOT analysis for the analyzed paper bag company.

In order to identify the waste specific to the production of paper bags, within the printing company targeted in the study, the manufacturing process was followed during a month of activity.

The observations made on the spot in the waste groups are as follows:

1. *Defects:* caused by the lack of attention of some workers; caused by inadequate quality materials; lack of prompt reaction of employees to various problems; performing several work tasks in parallel by a single worker; moral used equipment; inadequate qualification of some workers; the soldering devices of the machine are not cleaned in time;
2. *Lost time:* frequent failure of the printing + gluing machine, relying on the efficiency of another worker (in the case of the bag assembly line); the lack of a well-arranged space for preserving the forms of printing, equipment adjusting, insufficiency of materials and semi-finished transport systems; lack of an automatic product counting system which involves manual work with related activities;
3. *Unnecessary movements:* the lack of a unique algorithm for manual assembly of the constituent elements of the product made for all workers working on this line; lack of order at work; inefficient organization of production spaces;
4. *Unnecessary stocks:* of raw materials and finished products;
5. *Unnecessary transport:* efficient logistics.

Conclusions

Conclusion (1). Customers of printing products have now become more and more demanding and especially want a short lead time and costs as low as possible. In response, printing companies are constantly trying to improve their approach and manufacturing process. Thus, many of them use the tools specific to the Lean management system.

Conclusion (2). Lean tools can be implemented in companies with any type of activity, even in printing companies. The most commonly applied Lean tools in this field are 5S, Six sigma, SMED. At the same time, it was attested that tools such as: Poka Yoke, Heijunka, Bucket brigades, Jidoka are not specific to the printing field, resulting from the characteristics of the production flow and appearance related to the diversity of printing products (such as construction and materials involved in their manufacture) namely in this area. The company Sunimport Rottaprint Cluj, producer of labels, demonstrated that it is possible to implement a Lean tool, such as Kaizen, and to maintain it continuously, by obtaining, in 2015, the Kaizen Romania award.

Conclusion (3). The case study targeted a printing company in the Republic of Moldova that annually makes 10 million paper bags for the domestic and foreign market. The aim of the study was, at the initial stage, to perform the SWOT analysis and identify the waste.

Conclusion (4). The SWOT analysis allowed the identification of the strong points related to production spaces, the productivity of the equipment, the competence of the managerial staff and of the one involved in the production. At the same time, threats have been identified that need to be thoroughly analysed continuously in order to create a well-developed strategy.

Conclusion (5). A large part of the time wasted on the printing company included in the study, such as: slow decision-making, inefficient movement of workers, relying on the productivity of others' work are common activities, encountered on the spot. And the occurrence of defects with the highest frequency are caused by the lack of attention from some workers and that the soldering devices of the machine are not cleaned in time.

Conclusion (6). Knowing this initial data, the printing company producing paper bags can prepare for the implementation of a Lean tool, not before conducting Lean surveys and establishing a long-term action plan. It is important to hold regular meetings with workers in parallel so that they know the intentions of the management, to become familiar with Lean principles, to be trained in this regard. Cooperation and mutual trust will ensure the success of adopting a Lean management system, but will also make possible continuous improvement.

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