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Procedia - Social and Behavioral Sciences 238 (2018) 492 – 500

Procedia Social and Behavioral Sciences

SIM 2017 / 14th International Symposium in Management

Lean manufacturing in SMEs in Romania

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Abstract

This paper aims to bring to the forefront a concept that has put its mark on the manufacturing process development over the past two decades, namely lean manufacturing.

The objective of the theoretical part of the article is, by summarizing the information existing in the literature, to present the meanings given to the concept of lean manufacturing and how it can be implemented in organizations (steps to be followed, success factors, barriers), the term evolution and the emergence of a new concept - Lean Six Sigma.

The second part is an investigative approach to the interest of Romanian bloggers in studying the lean manufacturing phenomenon, especially a well-known instrument of it, just-in-time production method.

The information obtained has shown that although the concept is an intensely studied international literature, in the autochthonous approach is in the early stages.

Peer-review under responsibility of SIM 2017 / 14th International Symposium in Management.

Keywords: lean manufacturing; lean six sigma; just-in-time

1. The emergence of lean manufacturing

Rose, Deros, et. al. (2011) argue that the last two decades were dedicated for research aimed at improving the manufacturing process. They bring into question the lean manufacturing, total quality management, total productive maintenance and their application within various manufacturing companies.

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Peer-review under responsibility of SIM 2017 / 14th International Symposium in Management.
doi:10.1016/j.sbspro.2018.04.028

In their opinion, "it was proven that lean manufacturing was considered as the best manufacturing system in the 21st century". (Rose, Deros, et. al., 2011, pp. 872)

In the same idea, Kodali (2009) believe that lean manufacturing came to the attention of companies worldwide, irrespective of the sector they belong. According to him, implementation of lean manufacturing has become a necessity among organizations wishing to operate on a global market. Although its implementation benefits are undeniable, in his opinion, not many companies have resorted to implementing its principles and philosophies.

We believe it is essential to know where it started interest in what today is called lean manufacturing.

Toyota is generally recognized as the birthplace of lean. (Worlev, 2004, pp. 11)

Pepper and Spedding (2010) assigned the starting point of what is now known as lean thinking to Toyota company. According to them, the lean current comes from The Toyota Production System and "the development of this approach to manufacturing began shortly after the Second World War". They mentioned that "forced by shortages in both capital and resources, Eiji Toyoda instructed his workers to eliminate all waste". (Pepper and Spedding, 2010, pp.138)

Lean is "a set of principles, philosophies and business processes to enable the implementation of it, which is widely known and implemented since 1960". (Rose, Deros, et. al, 2011, pp. 872)

Manotas Duque and Riviera Cadavid (2007, pp. 71) have similar opinions. They affirm that "Lean Manufacturing was developed by Toyota Motor company to address their specific needs in a restricted market in times of economic trouble".

So we can observe that the above authors have de same approach and place the lean current appearance around the same period.

However, the above authors come yet with a distinctive note. They state that this trend begins with Henry Ford, somewhere in 1913, in the Highland Park manufacturing plant. "There, a set of practices and tools (interchangeable parts, standard work and the assembly flow line) was put in place in such an integrated way that allowed them to turn out products at incredible speeds, with very short flow times and high consistency. This system was not very flexible, though." (Manotas Duque and Riviera Cadavid, 2007, pp. 71)

According to them, the Toyota would take over the practice after a visit to Ford by Kiichiro Toyoda (member of the founding family of Toyota) and Taiichi Ohno (Toyota's leading manufacturing engineer), after World War II. They noted that some elements observed in the trial of the Ford can be adopted successfully in their company.

Some of the items taken and processing carried out in this respect: "they changed the emphasis from machine and workstation optimization to product flow through the total process, implementing some clever and "simple" ideas like dimensioning the manufacturing resources according to actual demand (rightsizing), improving the self-monitoring capabilities of equipment to ensure quality (Jidoka), designing the process layout to facilitate the sequence of the operations (Group Technology), studying and improving quick setups to enable rapid changeovers (SMED) and the use of kanbans to coordinate the production pull from and link one workstation to its predecessors and successors, and also to link the company with its suppliers and enable JIT supply". (Manotas Duque and Riviera Cadavid, 2007, pp. 71)

"The first step in a lean transition is to identify value-added and non-value adding processes". (Pepper and Spedding, 2010, pp. 138)

"In the literature, value is simply defined as what the customer is willing to pay for. Non-value added activities are generally understood to be either waste, or incidental activities that are necessary but add no value to the product". (Rogstad, 2010, pp. 15)

"Lean Manufacturing is a collective term for production practices aimed at increasing value creation and reducing waste in all forms. Lean Manufacturing focus on shortening the timeline between customer order and shipment, as well as cutting costs and improving quality, by identifying and eliminating waste in the value stream". (Bakås, Govaert, Van Landeghem, 2011, pp. 2)

Seven forms of waste have been identified in these sense (Pepper and Spedding, 2010, pp.139):

- *over-production;*
- *defects;*
- *unnecessary inventory;*
- *inappropriate processing;*

- *excessive transportation;*
- *waiting;*
- *unnecessary motion.*

"Waste in a manufacturing environment can be defined as any redundant application of resources that does not add value to the product, i.e., activities for which the customer is not willing to pay". (Sahoo, Singh, et. al., 2008, pp.453)

Russell and Taylor (2000, pp. 737), cited by Pepper and Spedding (2010), defined waste as "anything other than the minimum amount of equipment, materials, parts, space and time which are absolutely essential to add value to the product".

2. Lean manufacturing implementation

In the literature are presented numerous lean practices. It is known that there is no universally applicable formula. However, worth noting that lean practices and principles can be successfully implemented in any organization, are transferable and applicable to any organizations, no matter its size or activity. Every organization must find the combination of practices that can be adapted to their specifics.

Toyota believes that practices are a specific response to a problem. (Worlev, 2004, pp. 16)

"The implementation of a lean manufacturing strategy represents a robust contribution to the phase sequence that leads to operational excellence and the continuous improvement through the elimination of nonvalue-added activities. Therefore, lean practices contribute substantially to plant operational performance". (Álvarez, Calvo et. al., 2009, pp. 949)

The article by Rose, Deros, et. al. (2011, pp. 873), find lean practices grouped in three categories:

- those that are independent of the size of firm;
- those that relate to the size of firm and may be more difficult for SME to employ;
- those that can be implemented in piecemeal such set up reduction, 5S, TPM, multifunction employees.

The same authors present the list of best lean practices for SMEs companies: "reduce set up time, Kanban, small lot size, supplier management, preventive maintenance, multifunction employees, uniform workload, visual control, employee involvement (quality circles), Total quality management, training, teamwork, production smoothing continuous improvement, 5S and standardization". (Rose, Deros, et. al., 2011, pp. 874)

Worlev (2004) states that some of the most prevalent lean practices include kanbans, kaizen events, Five 5 events, one piece flow, quick changeovers, mistake proofing, reduced cycle time, value stream mapping, and reduction of inventory.

Universally accepted idea in the literature is that lean implementation involves two basic concepts: eliminate waste and create value.

Emiliani (1998), based on Womack and Jones (1996) presents in these sense a more *detailed framework with five basic steps* (Manotas Duque and Riviera Cadavid, 2007, pp. 72):

- *specify value* (what/when and how do customers / What combination of features, capabilities, availability and price will be preferred by them?);
- *value stream analysis* (the collection of processes and activities required to bring a product to the customer, from beginning to end);
- *continuous flow* (companies should try to make value flow continuously, not in batches);
- *customer pull* (the companies should not push their products to customers, and rather let them pull "value", products or services, and link all the production chain in such a way that materials are not released and activities are not done until they are needed);
- *continuous improvement* (it is the conviction that improvement efforts are never finished, and it is the consistency to keep the discipline for improvement in place - kaizen).

Manotas Duque and Riviera Cadavid (2007) presents the *steps to follow in lean implementation*:

- *planning the change* (define the need for change, top management commitment and support, identify target areas, model lines and propagation strategy);
- *implementation* (elimination of waste, continuous improvement, continuous flow and pull-driven systems, multifunctional teams, information systems);
- *measuring the progress*;
- *purpose of the metrics* (monitoring the progress of a lean implementation, continuous monitoring, benchmarking).

Pepper and Spedding (2010) presents in their article some elements that *limited the success of lean implementation*:

- huge product portfolios mean that each "job" is likely to be different and therefore production approaches cannot be standardized;
- the products characteristics create production constraints;
- the job-shops or smaller firms simply cannot match the dominance or resources that the larger firms enjoy, allowing them to be inflexible along their supply chains.

More *barriers* was found in implementing lean practices in SMEs. Although there exist characteristics that sustain these process, there are also obstacles and barriers that can be identified.

Bakås, Govaert, and Van Landeghem (2011), based on Achanga et. al. (2006) and Yang & Yuju (2010) remember once of these:

- *unfamiliar with lean manufacturing;*
- *"not for us" - misunderstanding of the lean concept;*
- *not sufficient resources;*
- *staff resistance to lean production;*
- *implementing lean without adapting it to the company specific setting.*

In literature are found success factors that support lean implementation in organizations.

Liker (1998), cited by Manotas Duque and Riviera Cadavid (2007), identicated four *key factors for success* in the implementation of a lean effort:

- *preparation and motivation of people;*
- *roles in the change process;*
- *methodologies for change;*
- *environment for change*.

Bakås, Govaert and Van Landeghem (2011) presents another *critical success factors.* According to them, Based on the literature review, a set of areas were identified as potential important factors for succeeding with lean implementations in SMEs:

- *leadership and management involvement;*
- *employee involvement and sufficient participation;*
- *motivation and learning;*
- *performance evaluation systems;*
- *communication of goals and objectives with improvement initiatives;*
- *linking improvement initiatives to business strategy and customers.*

The same authors offer a *guidelines for lean implementations in SMEs:*

- *strong management involvement* (management support);
- *sound involvement of employees* (the employees need to believe in the change that is about to happen);
- *allocating sufficient time for change;*
- *motivation;*
- *"learn it – don't buy it"*;
- *performance measurement and KPIs.*

Once discovered the lean practices ensuring the organization success, the benefits of their implementation will not delay to appear. These may include: reduced build time, increased quality, increased customer satisfaction, reduced inventory, increased workplace safety, and reduced set-up times for machinery are cited frequently, reduce the cost of doing business, increased efficiency, improved employee morales and many others. It is important to know that this would be possible "without effective workforce training and support, the lean manufacturing implementation will fail". (Ichimura, Arunachalam and Page, 2008, pp. 29)

Lean manufacturing implementation is analyzed from several perspectives: conceptual, the best practices, the guidelines, success factors and barriers that organizations can face during this process. (Table 1.)

Table 1. Lean manufacturing implementation – issues addressed in the literature

Issues addressed	Years	Authors
Definition	2009	Alvarez, Calvo et. al.
Lean practices	2004	Worlev
	2011	Rose, Deros, et. al.
Guidelines	1998	Emiliani based on Womack and Jones
	2007	Manotas Duque and Riviera Cadavid
Barriers	2010	Pepper and Spedding
	2011	Bakås, Govaert, and Van Landeghem based on Achanga et. al. (2006) and Yang & Yuju (2010)
Success factors	2007	Manotas Duque and Riviera Cadavid
	2011	Bakås, Govaert, and Van Landeghem

Source: Own adaptation based on information sources

3. Improving the Lean stream – Lean Six Sigma

From the desire to eliminate weaknesses of lean manufacturing model and its improvement, a new concept was introduced and implemented in organizations: *Lean Six Sigma.*

"The sigma, or standard deviation, tells you how much variability there is within a group of items (the "population"). The more variation there is, the bigger the standard deviation, In statistical terms, therefore, the purpose of six sigma is to reduce variation to achieve very small standard deviations so that almost all of your products or services meet or exceed customer expectations". (Rogstad, 2010, pp. 21)

Zhang (Corresponding Author), Irfan et. al. (2012, pp. 599) defined it like "a combination of wellknown waste elimination and process improvement techniques". In their opinion, "it applies the tools and techniques of both Lean manufacturing and six sigma", which leads to a higher power, eliminating the cons of each approach.

In the same idea, Pepper and Spedding (2010) states that "the term Six Sigma refers to a statistical measure of defect rate within a system".

Although its implementation benefits have been recognized over time, existing studies in the literature show that a limited number of organizations around the world have started to use it.

Zhang (Corresponding Author), Irfan et. al. (2012) made a detailed literature review on this subject. The search years included are from 2000 to December 2011, nothing that were not found articles on this subject, before 2003 using the searching databases. They discovered that "the lean six sigma is mainly implemented in the Health sector

where the defects are less tolerable" and "in the information technology and related industries like telecommunication and computer manufacturing, Lean six sigma was used frequently". (Zhang, Irfan et. al., 2012, pp. 599-560)

4. Lean Six Sigma design

M.P.J. Pepper and T.A. Spedding (2010) mentioned in their article a few aspects that should be taken into account when *building a Lean Six Sigma model*:

- *it needs to be strategic and process focused;*
- *the framework should be balanced between the two philosophies to harness the recognised advantages of both;*
- *a balance between complexity and sustainability must be reached;*
- *it should be structured around the type of problem experienced.*

Kumar et. al. (2006), cited by the authors mentioned above, listed several issues that discovered in the process of implementing lean techniques and six sigma model in indian SMEs:

- *there is no standard framework for lean Six Sigma;*
- *there is no clear understanding concerning the usage of tools, etc., within the lean Six Sigma frameworks;*
- *with the framework presented, there is no clear direction as to which strategy should be selected at the early stages of a project.*

5. The survey: Just-in-time production method

In the second part of the paper, we have designed to investigate how one of the lean manufacturing tools, namely the just-in-time production method, is in the interest of those who have created gender blogs in Romania, posting various articles on this topic and starting discussions with other interested people.

Thus, in order to achieve the proposed ones, we have recourse to a qualitative, descriptive research, which consists of following the steps below:

- identify blogs on the profile (lean manufacturing and even just-in-time);
- identify the issues that have been addressed in just-in-time production.

In the first stage, identifying our romanian blogs, we started from the premise of a significant number of blogs on this topic, given the importance of approaching the lean manufacturing principles in terms of the benefits offered by any company, regardless of its profile and its size.

The surprise was to find that in practice things are not even favorable. So, although the expectations were very high, we identified only 3 blogs that fit into the research, lean manufacturing and just-in-time production.

After finalizing the second stage, we noticed that aspects such as the definition of the term, the context of its occurrence, the implementation of the just-in-time production method, its advantages and disadvantages were the only points approached by bloggers.

All of the above mentioned are found in the table below (Table 2. Approach of the just-in-time production method on profile blogs).

Table 2. Approach of the just-in-time production method on profile blogs

No	Romanian blogs	Issues addressed	Bloggers approach	Source: blog link
1.	LeanRomania Weblog	Term definition	"JIT is an integrated set of activities designed to determine maximum production with minimum stocks (materials, unfinished production, finished products) by eliminating losses and reducing delivery times from one station to another, requiring stable and controlled processes, continuous manufacturing flows and a "pulled" (Pull) production system."	https://leanromania.wordpress.com/instrumente-lean/jit/
2.	Lean Blog Romania	Term definition (completing the term with a new concept: Just-in-Sequence	The order of the components supplied just-in-time for the proper operation of the assembly line must strictly respect the order and position of assembling successive different products.	http://www.leanblog.ro/wp/jit-jis-in-productie-si-nu-numai/
		Advantages	"JIS production exactly meets the requirements of customers in the order they arrive if they are similar, but very different products at the same time, as in the case of automobiles. JIS involves synchronizing and optimizing processes while reducing inventory and time required for the product to go out on the line to quickly meet customer demand (Lead Time). As indicators, JIS means a 60-90% reduction for Lead Time, a 50% reduction in inventory, a 20% reduction in shipping and storage costs, a 25% improvement in quality, flexibility and productivity A decrease of around 8-12% of total costs (source: Roland Kafer, 2007, Study on a sample of 172 European companies)."	
		Disadvantages	"JIS, like JIT, due to lack of stocks, causes a very high sensitivity to the risk of problems with transport routes or quality problems. Another risk that can often turn into a drawback is precisely the flow of information on the supply chain."	
3.	FEROVIARII	Appearance	"It has emerged as a response to classical organizational methods, based on the existence of buffers, set up to counteract the various negative events that can defend themselves in the production process (accidental stoppages, lack of staff, workshop dismantling, defects Quality, etc.)"	http://christianferoviarul.blogspot.ro/2008/11/metoda-just-in-time.html
		Term definition	"At the basis of the J.I.T. It is the principle of minimizing or eliminating stocks of raw materials, materials, parts, subassemblies and unfinished production, and implicitly reducing the overall cost of these stocks, regardless of the volume of production. The minimization of all categories of stocks is made in parallel with the increase in product quality. According to this method, only what is sold and exactly on time must be produced."	
		Implementation	The implementation of the J.I.T. Involves the realization of six fundamental actions: - rational location of organizational links in order to reduce costs associated with non-value creation operations (mainly transport operations); - reduce preparation and completion times in order to achieve an optimal time to change the series achieving maximum machine reliability in order to reduce the cost of parking due to accidental falls; - producing a high quality production; - performing the quality control activity according to the principle "total control under the conditions of selective control" - establishing a partnership relationship with the suppliers; - educating and training the workforce using the most effective methods."	
		Advantages	'Reducing costs by reducing inventories, reducing scrap, reducing working time and reducing changes to the original project; - increasing revenue by improving product quality and increasing sales volume. - reducing investment, both by reducing storage space and by minimizing inventories; - improving staffing; The workforce is very well prepared, materially motivated, attached to the firm and responsible for the results of the work; All these features determine the increase in labor productivity."	

Source: Own adaptation based on information sources

In conclusion, analyzing the data obtained, it is observed that the terms are unanimous regarding the definition of the term. It is believed that this method has the ultimate goal of achieving a maximum output with minimal or even non-existent stocks. It also aims at eliminating losses and reducing the delivery time of products from one station to another.

On LeanRomaniaBlog, a new term is introduced in JIS just-in-time definition (JIS), which implies synchronization and process optimization, while reducing the inventory and time required for the product to go out on the line to quickly meet customer demand (Lead Time) ".

Regarding the implementation of the production method in organizations, one of the analyzed blogs recommends six actions considered to be fundamental in this respect. They are found in the table above.

Analyzing the advantages and disadvantages found, there are many advantages that are presented in the table and a limited number of insignificant disadvantages. So the number of benefits is considerably superior to the disadvantages.

6. Conclusions

Lean manufacturing is considered to be one of the most important developments in the 21st century. It seems that his birth is due to the prestigious Toyota.

It seems that this thinking has been taken up by companies around the world, especially those who want to gain and maintain a place in a global market. All this, due to the many advantages that it proposes to implement by companies.

Lean manufacturing is based on an extremely simple principle: identifying value-added processes and those that do not add value to a company and which the customer is not willing to pay.

The specialized literature presented in the theoretical part of this paper suggests that although the benefits of implementing this thinking in organizations are significant and unquestionable, not many companies have gone into this action.

In the second part of the paper we focused on identifying how an important instrument of lean manufacturing, namely the just-in-time production method, is presented by some connoisseurs and interested in the field in Romania, the bloggers gender.

Thus, we first found the existence of a very small number of bloggers in the field of lean manufacturing and then the lack of detailed information on the just-in-time production method.

References

Álvarez, R., Calvo, R. et. al. (2009). Redesigning an assembly line through lean manufacturing tools, *Int J Adv Manuf Technol*, 43:949–958 DOI 10.1007/s00170-008-1772-2

Bakås, O., Govaert, T., Van Landeghem, H. (2011). *CHALLENGES AND SUCCESS FACTORS FOR IMPLEMENTATION OF LEAN MANUFACTURING IN EUROPEAN SMES*, MITIP 2011, Norwegian University of Science and Technology, Trondheim, Norway

Ichimura M., Arunachalam S., Page T. (2008). An emerging training model for successful lean manufacturing – an empirical study*, i-manager's Journal on Management*, Vol.2, No. 4, March – May 2008, pp, 29 – 40

Kodali, G. (2009). Selection of lean manufacturing systems using the analytic network process – a case study, *Journal of Manufacturing Technology Management*, Vol. 20 Issue 2, pp. 258 – 289

Manotas Duque D. F., Riviera Cadavid L. (2007). Lean Manufacturing Measurement: The Relationship between Lean Activities and Lean Metrics, *Estudios Gerenciales*, Vol. 23, No. 105 (Octobre – Diciembre, 2007), pp. 69 – 83

Pepper, M. P. J., Spedding, T. A. (2010). The evolution of lean Six Sigma*, International Journal of Quality & Reliability Management*, Vol. 27, Issue 2, pp. 138 – 155

Rogstad, R. S. (2010). *Implementing Lean Manufacturing Principles in a Manufacturing Environment,* A Research Paper Submitted in Partial Fulfillment of the Requirements for the Master of Science Degree in Manufacturing Engineering

Rose, A. M. N., Deros, B. Md., Rahman, M. N. Ab. & Nordin, N. (2011). Lean manufacturing best practices in SMEs, *Proceedings of the 2011 International Conference on Industrial Engineering and Operations Management Kuala Lumpur, Malaysia,* January 22 – 24, pp. 872 – 877

Sahoo , A. K., Singh N. K. et. al. (2008). Lean philosophy: implementation in a forging company, Int J Adv Manuf Technol) 36:451–462, DOI 10.1007/s00170-006-0870-2

Worlev, J. M. (2004). ”The Role of Sociocultural Factors in a Lean Manufacturing lmplementation” for the degree of Master of Science in Industrial Enqineerinq presented on December 1

Zhang, Q., Irfan, M., Khattak, M. Zhu, X., Hassan, M. (2012). ”Lean Six Sigma: A Literature Review”, *INTERDISCIPLINARY JOURNAL OF CONTEMPORARY RESEARCH IN BUSINESS,* FEBRUARY 2012, VOL 3, NO 10, pp. 599 – 605

https://leanromania.wordpress.com/instrumente-lean/jit/

http://www.leanblog.ro/wp/jit-jis-in-productie-si-nu-numai/

http://christianferoviarul.blogspot.ro/2008/11/metoda-just-in-time.html