

Bibliometrics About Lean Manufacturing

Manoel GONÇALES FILHO*, Nilton Cesar CARRARO*,
Lisleandra MACHADO*, Rosenira Izadel de OLIVEIRA*,
Maria das Graças J. M. TOMAZELA*, Fernando Celso de CAMPOS*

*Universidade Metodista de Piracicaba Rua Luís Ometo, 1 - Distrito Industrial I,
Santa Bárbara D'Oeste – SP – 13450-000 Telefone 19 3124-1767.

Abstract:-This paper developed an analytical background to scientific development conducted on the use of Lean Manufacturing in the industries. Regarding the methodological approach to this research is exploratory and did a literature review with a sample survey using technological resources search as a tool to perform the search in this case, the component data bases Journals Portal Coordination and Training of Personnel Higher Level. For this study bibliometric analysis and the selection of journals were made and the results show that the topic is Lean Manufacturing on the rise internationally and that is a methodology mentioned in leading journals. The scientific literature on the topic is not predominantly done by a single magazine or a single industry segment. The contribution is in identifying the gaps of the segments of the industries with the greatest opportunities for the application of Lean Thinking so that future studies can deepen effectively is opportunity.

Keywords:-Lean Manufacturing, Lean Thinking, Bibliometrics.

I. INTRODUCTION

One of the main tasks of scientific articles is at disseminating knowledge through the publication of the results of scientific research. This dissemination spread is of great value, because it allows other professionals have the opportunity to meet, question and evaluate problems that may arise on the issues studied and related (NEVES, 2013).

The articles published in various journals on existing evaluation III in Engineering portal of CAPES - Coordination and Improvement of Higher Education Personnel constitute the portfolio necessary for the development of this work.

Conducting research to identify the little exploration of scientific papers in the segments of industries related to projects of Lean Manufacturing (ME) applications is necessary so that they can diagnose gaps, which need attention and future developments. In other words, what industry segments underexplored by ME?

Therefore, the purpose of this study is to diagnose and analyze the published works in an attempt to better understand what has been done by the industries most exploited and which segments.

The bibliometric research is on the lifting of the quantitative data of scientific recognition, the quality of publications and media publicity.

II. THEORETICAL BENCHMARK

Bibliometry emerged in the early twentieth century as a tool to monitor the growth and development of different areas of science. This rise occurred in function of perception, on the part of scientists, in relation to the amount of scientific knowledge generated at the time, beyond the capability of reading (ROSTAING *et al.* NEVES, 2013).

This article uses the techniques of bibliometrics to evaluate the scientific production focusing on the theme ME therefore initially be treated starting from the origin of the Lean Production System that, based on the version of Womack and Jones (1996), appeared in Japan at the end of World War II. These authors are based on the production process employed by the Japanese Toyota had proposed as a viable and efficient company in automobile manufacturing. According to Oprime (2012), this practice was known then that provided by mass production, or manufacture in high volume standardized to market a broad product dimensions. Thus, for the Toyota, the solution was how to competitively produce a wider variety of designs in small quantities. Thus, the problem was to achieve efficiency and cost reduction no longer based on economies of scale, but in other elements of manufacturing output.

According to Davenport (1994), the construction of the Lean concept serves as an "umbrella" to cover all the methods that were based on reducing waste in the environment, however different they are in their format and contents of current existing and its corporate culture.

Thus, (PE) and clinging to the Lean tools possibly good results can be achieved. As Womack and Jones (1996) should be sought elimination of all waste and aim to create wealth - or value. The companies have lost

sight of the value and how to create value for the customer. It creates waste. Need the EP to help companies specify value correctly. Aligning all activities that create value for a specific product along a value chain and cause the value to flow according to customer needs, striving for perfection and continuous improvement.

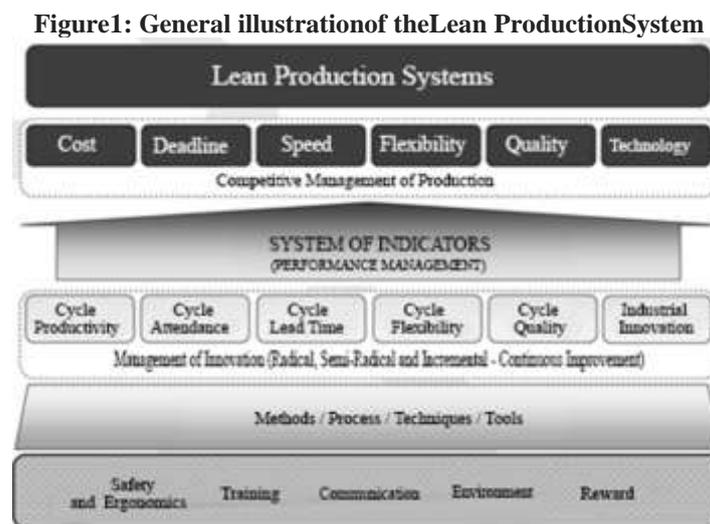
To Bhasin (2012), each company must find its own way to the Lean program. Managers were drowned in attempting to implement techniques to isolated parts of a lean system without understanding the whole. A reliable guide to action implementation is the five principles of PE: i) accurately determine the value by specific product; ii) identify the value chain for each product; iii) make value flow without interruptions; iv) let the customer pull value from the producer; v) seek perfection.

Changes (in Japanese, waste), has to do with activities that do not create value, errors that require rectification, production of items that nobody wants, accumulation of goods in stock. Processing steps that actually were not needed. Movement of employees and transport of goods from one place to another without purpose. Groups of people in a subsequent activity that are waiting because a previous activity was not carried out on time, in short: goods and services that do not meet customer needs.

Figure 1 shows the model of the Production System developed by company management Produttare for Production Systems that have been implemented in Brazilian companies, it is a reference model that synthesizes all this theoretical and conceptual framework of the Production System lean.

All teams of a company who follow the same approach, are possible precisely measure the waiting time and continuously improve their design methodology (WOMACK e JONES 1996).

With the adoption of the EP - Lean Thinking many companies achieved superior performance in various dimensions that were considered conflicting, such as low cost, high quality, speed and flexibility. Competitive priorities can reinforce each other, (PORTER, 1980).



Source: Produttare (2014).

However, what objectives are conflicting and which may be reduced or eliminated with the application of ME? Are questions that must be made when trying to use a strategic perspective.

Thus, the implementation of the EP is a process of continuous improvement, in which learning should be used to manage the change. For the organization to benefit from the knowledge generated, the approach of emergent strategy proves to be quite consistent. The consistency of behavior required by the lean philosophy leads to development of plans for long and short term to encourage the use of learning generated and stimulate the generation of knowledge. Furthermore, the potential generated and the characteristic of the changing market needs can lead to issues to be observed throughout the implementation process.

Hayes (1981) e Veiga *et al.* (2008) state that the success of Japanese is not due to use of futuristic techniques, but the attention to basic aspects of manufacturing. All stages of the manufacturing process, from product development to distribution, are also important. They work constantly improving equipment design, system inventory control, and skill of workers through cooperation at all levels. In addition, each employee was trained to solve small problems that arise in day-to-day, to conduct regular preventive maintenance, and to continually seek ways to eliminate potential interruptions and improve efficiency. It is visible consistency and discipline in the Japanese manufacturing operations.

Many companies are using the best lean practices as the basis of their manufacturing strategies. The best practice approach involves the philosophy of WCM (*world class manufacturing*) and *benchmarking* and that

is based on the continuous improvement of best practices in all areas of the organization argument leads to superior performance by improving their competitiveness (VOSS, 1995; VEIGA *et al.*, 2008). Thus, one can consider that the practices, considered best, cover the contents of this paradigm of manufacturing strategy and *benchmarking* is the process.

III. METHODOLOGY APPROACH

The methodological approach of this research is characterized as exploratory, descriptive and documental (GIL, 2008), which employs a deductive (CRUZ, RIBEIRO, 2004). On the design, it draws on literature and the survey sample, using technological resources search as a tool to perform the search (GIL, 2008), in this case, the component data bases Journals Portal CAPES - Coordination and Improvement of Higher Education Personnel. For a survey and analysis conducted in this study the following steps were taken: i) Search term - selection of periodicals; ii) reading the titles, abstracts, keywords of the items returned; iii) Reading the methodology and results of the returned items; iv) Tabulation and evaluation of data obtained; v) Identification of Articles segment and vi) Application Tips for future work in segments with little scientific exploration.

Therefore, Periodicals have consulted your articles available for online consultation, technological search capabilities have been used, thereby facilitating the collection of data.

The first step was to research the keywords "*lean+applications+industry*" in international journals selected, considering the last 15 years. This survey was conducted with a focus on international journals (Journal) bases that were available in the web page.

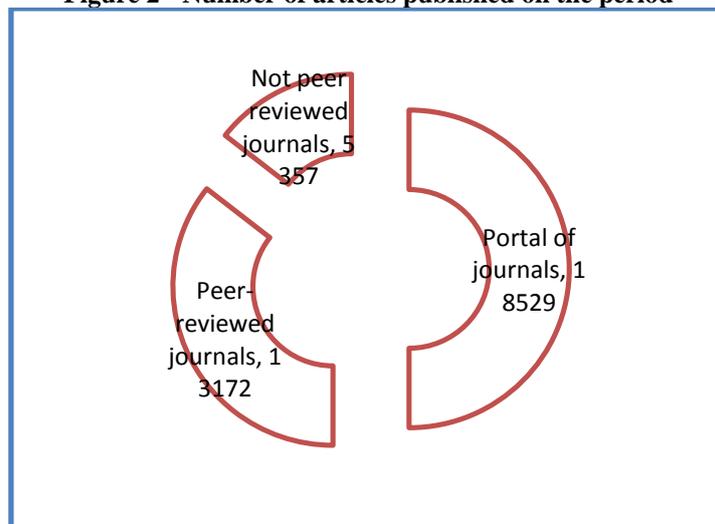
Regarding step two, the topics were selected to approximate the contents of the articles to the topic being developed. In step three, a tab was made with the goal of visualizing the languages in which international articles were written. In step four, a tab was made with the aim to know the collections that were participating in the production of articles. In step five, the resource used and the focus given to the type of document used. In step six, the selection of articles by publication date. In step seven, was mounted stratum Qualis Capes (Engineering III) of all journals in order to analyze the classification of journals. And finally, in step eight, the segment of industries worked within these selected articles from all titles, abstracts, keywords, their research methodologies and findings.

In the last step of sorting and reading the articles, then followed him to the last stage: the tabulation and evaluation of its characteristics, the results are presented and discussed below.

IV. RESULTS AND DISCUSSION

This research started from data generated in consultation with the Portal Capes and process the first data to be computed was the total number of detailed in Figure 2 international papers available at the base.

Figure 2 - Number of articles published on the period

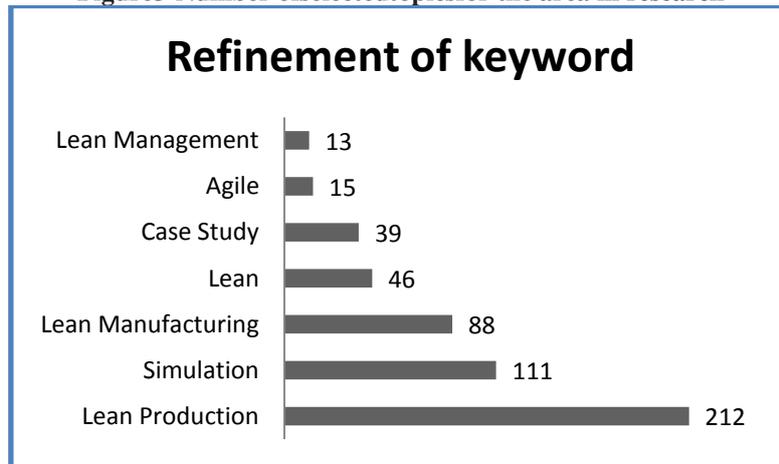


Source: by authors based on the CAPES web page (2014)

It was observed that by using key words: *lean+applications+industry* found 18,529 articles available, and of these articles, the peer reviewed totaled 13,172 units, and this was the initial base crafted.

Continuing the selection, the topics were added (refinement of keyword) to approximate the contents of the articles to the topic to be developed as shown in Figure 3.

Figure3-Number of selected topics for the area in research



Source: by authors based on the CAPES web page (2014)

Found 212 articles to the topic *Lean Production* representing a 40% of selected. It may be noted that the second most significant contribution has been the topic *Simulation* 21% and a total of 111 items, followed by topical *Lean manufacturing* with 88 journals. For *Lean*, *Case Study*, *Agile* and *Lean Management* topics found 113 articles.

A panel was also performed in order to visualize the languages in which international articles were written. It is observed that the number of publications in English is much higher than publications in other languages, especially the Portuguese, with 124 articles in English, 22 in German and one in Spanish.

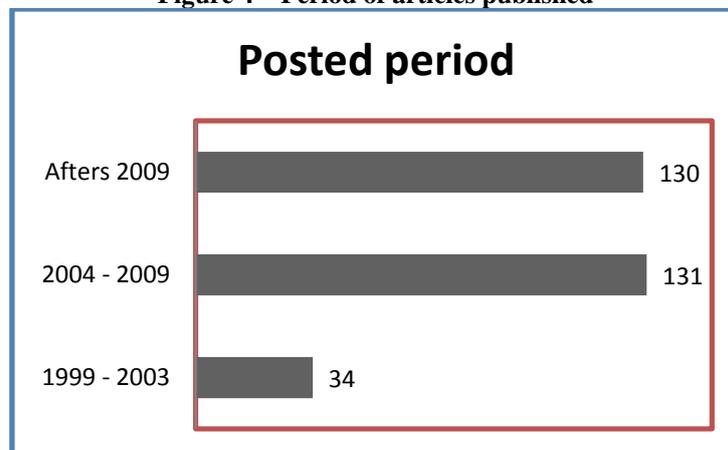
Subsequently, a tabulation was made with the aim to know the collections that were participating in the production of articles.

It is observed that the higher occurrence of publications mainly appears at the bottom *OneFile (Gale)* with 177 publications followed by base *Scopus (Elsevier)* with 144 publications and *SciVerse Science Direct (Elsevier)* with 77 publications, other holdings totaling 36 posts and bases are in *Arts & Sciences (JSTOR)*; *Sage Publications (CrossRef)*; *INFORMS Journals*; *Wiley Online Library*, and *Sage Journals Directory of Open Access Journals (DOAJ)*.

The predominant type of document was unanimously crafted in the shape of articles, were excluded from the final analysis all other types of documents, such as reviews, textual resources, minutes of conferences and journal articles.

Another fact presented and that contributes to the selection of items is the date of publication as shown in Figure 4.

Figure 4 – Period of articles published



Source: by authors based on the CAPES web page (2014)

It is noteworthy that the temporal positioning considered only those years in which they have occurred and publications from 1999 to the present day, read 2014, more precisely to 28 April 2014. Therefore 44% of the sample between 2009 and April 2014.

Analyzed other information was subsequently stratum Qualis Capes, and only within the Area Engineering III, of all journals, aiming to analyze from qualified journals in this area.

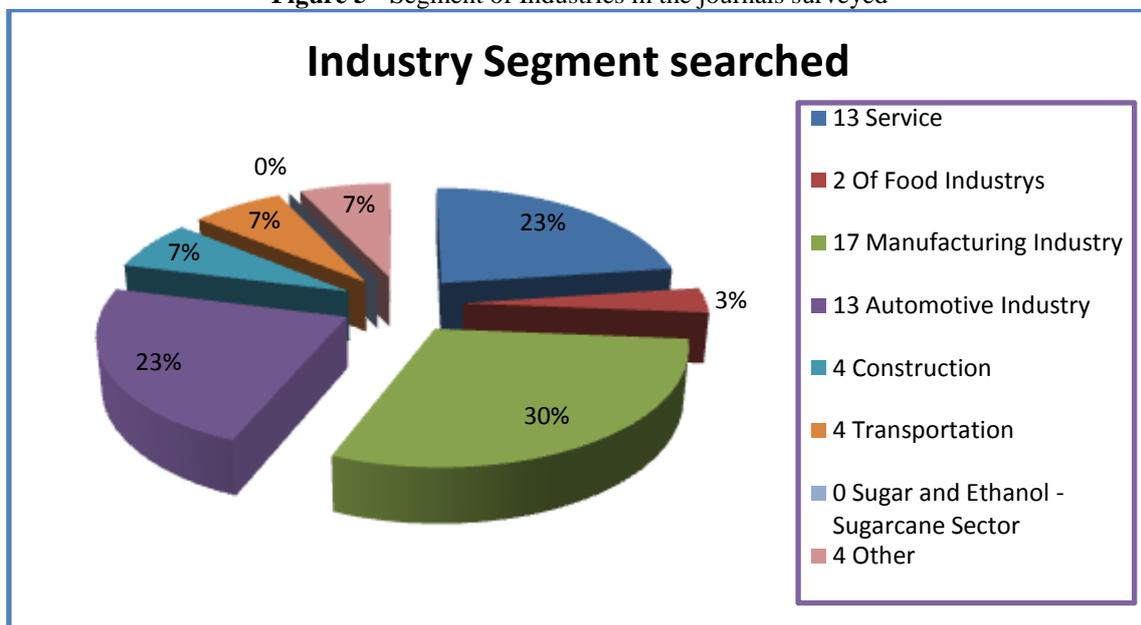
It was noticed that more than half of the journals have no classification in the area of Engineering III, but in other areas, such as computer science, biological sciences I, agricultural, administration, accounting and tourism sciences, interdisciplinary, medicine, psychology, biology II, among others.

However, 24 journals have qualification A1 and A2 10 journals. Although it was realized that 12 periodicals and 11 are rated B1 to B2, and that does not return any journal below this classification, we have no qualification B3, B4 and B5 as shown in Figure 8.

So far it has reached 57 articles and, as a result, we sought to find the segment of industries worked in the context of these selected articles.

For this achievement was necessary to put them all in a single database organized in which it could read all their titles, abstracts, keywords, its research methodologies and conclusions are presented in Figure 5.

Figure 5 - Segment of Industries in the journals surveyed



Source: by authors based on the CAPES web page (2014)

We observe that the Manufacturing Industry has the largest share with 30% to 17 items developed in this segment, the branch Automotive Service and has the same interest, both with 23% and 13 articles each. The Civil Construction and Transportation also tie with four publications, and are each 7% of the publications, since the Food are two articles and there are no scientific studies to the Sugar and Ethanol Industry of the sugar-energy sector jobs. Other segments have found four publications.

Therefore, the articles available shortly address the Food Industries nor the Sugar and Alcohol Industry's sugar-energy sector.

It appears that there is a future opportunity to be exploited in order to contribute to knowledge within registered with the greatest need for scientific production segment.

V. FINAL CONSIDERATIONS

The goal it has set itself the product was achieved because information was raised and drew up an analytical overview of scientific literature on the topic of ME in this set of journals surveyed by CAPES web page.

The results show that the topic is rising internationally and is a methodology mentioned in leading journals. The scientific literature on the topic is not predominantly done by a single magazine or a single industry segment, with gaps in some segments, especially the food and sugar and alcohol, the latter being the most opportunity to develop work and scientific research.

The contribution of this research is pointing in the opportunities related to the continuity of the work of scientific research and development of production processes in the industry through the methodology of ME segments underexplored.

Therefore, as a future research will be sought to increase the number of databases to be searched by CAPES Portal, in order to obtain greater clarity on the aspects of knowledge gap and opportunities for projects involving contribution of ME and the sugar and alcohol sector.

REFERENCES

- [1]. Bhasin, S. Department of Quality Assurance, NOMS Civil Service College, Newbold Revel, UK - Management Decision Vol. 50 No. 3, 2012 pp. 439-458
- [2]. Capes; Coordenação de Aperfeiçoamento de Pessoal de Nível Superior, disponível em <http://qualis.capes.gov.br/webqualis/principal.seam> - acesso em 15/04/2014.
- [3]. Cruz, C.; Ribeiro, U. *Metodologia Científica: Teoria e prática*. Rio de Janeiro: Axcel Books, 2004.
- [4]. Davenport, T. H. *Reengenharia de Processos*. Rio de Janeiro, Campus, 1994.
- [5]. Gil, A. C. *Como elaborar projetos de pesquisa*. São Paulo:Atlas, 2008
- [6]. Hayes, R. Why Japanese factories Work. Harvard Business Review. Jul/Aug, pp. 56-66, 1981.
- [7]. Neves, M. S. N. *et al.*, Estudo bibliométrico da metodologia ativa “PeerInstruction” de 2003 a 2013 – VIII Workshop de pós-graduação e pesquisa do Centro Paula Souza – São Paulo, 2013.
- [8]. Oprime, P. C., *et al.*, Análise da complexidade, estratégias e aprendizagem em projetos de melhoria contínua: estudos de caso em empresas brasileiras, *Gest. Prod.*, São Carlos, v. 17, n. 4, p. 669-682, 2012.
- [9]. Periódicos CAPES; Coordenação de Aperfeiçoamento de Pessoal de Nível Superior, disponível em <http://periodicos.capes.gov.br.ez100.periodicos.capes.gov.br/index.php?> - acesso em 15/04/2014.
- [10]. Porter, M. *Estratégia competitiva: técnicas para análise de indústrias e da concorrência* Rio de Janeiro: Campus, 1980.
- [11]. Prodtattare G. I. *Tecnologia e Gestão para Sistemas de Produção*. Disponível em: <http://prodtattare.com.br/institucional.php>, Acesso em 12/09/2014.
- [12]. Rostaing, H. *La bibliométrie et ses techniques*. Collection “Outils et methods”, co-édition sciences de la société et CRRM – *Centre de Recherche Retrospective de Marseille*. Marseille, 1996.
- [13]. Veiga, G. L., *et al.* Uma discussão sobre o papel estratégico do Modelo de Produção Enxuta. *SISTEMAS & GESTÃO*, v.3, n. 2, p.92-113, maio a agosto de 2008.
- [14]. Voss, C. A. Alternative paradigms for manufacturing strategy. *International Journal of Operations & Production Management*, Vol. 15, No. 4, pp. 5-16, 1995.
- [15]. Womack, J. P.; Jones, D. T. *Lean Thinking: Banish Waste and Create the Wealth in Your Corporation*. New York: Simon and Schuster, 1996.