This article aims to evaluate the use of lean manufacturing practices, according to SAE J4000, in a supply chain of the pharmaceutical industry. The data were collected in four companies: a manufacturer, a distributor and two suppliers. The results show companies are aligned in only one of the six elements of the standard.

Key Words: SAE J4000, lean manufacturing, pharmaceutical industry, supply chain management.

1. INTRODUCTION

Since Womack, in his book, The Machine that Changed the World (1990), brought to light evidence that the principles developed by Toyota could be replicated with excellent results in other industries outside Japanese borders, various industries were launched on this journey with evidence of gains and major results.

In this article we discuss a case study aimed at the supply chain of a multinational pharmaceutical industry large and see how the lean production practices as described and organized by SAE J4000, are being implemented by this segment along the chain.

Item 2 is a brief literature review, subdivided in items 2.1 which summarizes the lean principles, Section 2.2 focused on concepts related to the Supply Chain Management...
Review, Item 2.3 addressing the Society of Automotive Engineers (SAE), Section 2.4 will present the structure of the standard SAE J4000 used in this article and item 2.5 brings some facts and figures relating to the pharmaceutical industry in Brazil, the target of this study. In item 3 will be the presentation of the method, containing all stages used, since the preparation of studies, elaboration of criteria for selection of links in the supply chain, data collection, information organization and presentation of results. Section 4 presents the results obtained in the overall summary and analysis of variance (ANOVA one way) of the samples. In section 5 some final considerations will be elaborated based on the observation of the results presented.

2. LITERARY REVIEW

2.1 LEAN PRODUCTION SYSTEM

The system, created in the 1940s and perfected for over 20 years, was designed by the then production engineer Taichi Ohno. When Ohno was asked about how Toyota was getting its excellent results, it said, "all we're doing is looking at the timeline from the time the customer places his order to the time we collect the money." (OHNO, 1988)

As a result of the application of the tools proposed by the system obtains the continuous reduction of the losses described above and in this way the company can dramatically reduce their operating costs.

2.2 SUPPLY CHAIN MANAGEMENT REVIEW

Supply chain can be defined as a group of companies that provide all the necessary processes for the manufacture of a well finished (Davis, Aquilano and Chase, 2001).

"The supply chain management is the integration of key business processes to the end user through direct suppliers that provide products, services and information that add value to customers." (LAMBERT et al. 1998).

The Supply Chain Management (SCM) incorporates multiple processes and activities of suppliers to customers. (SOON AND Udin)

Thus it appears that competition occurs at the level of production chains, the so-called Virtual Business Units, and not at the level of the business units.
For Kim (2006), the supply chain management is to improve the competitive performance through the effective integration of internal functions within a company linking them with the external operations of suppliers, customers and other channel members.

According Ordoobadi (2009), the proper management of the supply chain is the key to the success of any company.

2.4 STANDARD SAE J4000

SAE J4000 is a tool to identify and measure the best practices in the implementation of lean operation in a manufacturing organization. Implementation of lean operation is defined as the process of eliminating waste in a value stream organization. Best practices in this process are the conduct level 3, as described in statements of standard components. The description of the implementation levels are: Level 1 This item is not implemented or there are large inconsistencies in implementation. Level 2, the item is implemented, but there are minor inconsistencies in implementation. Level 3, the item is implemented fully and effectively. Level 4, the item is fully implemented, effectively and show improvement in performance over the last 12 months.

The main section of the standard is composed of 52 components divided into six elements that assess the degree of implementation of the principles of lean operations in a company (DURAN & BATOCCHIO, 2001).

Although this standard has been created and implemented largely within the automotive sector, we intend to use it in check in a chain of pharmaceuticals, as further explained in subsequent chapters.

2.5 PHARMACEUTICAL INDUSTRY IN BRAZIL

In Brazil, there are approximately 369 companies operating in the pharmaceutical industry in Brazil, 17% of them foreign capital and 83% of the national capital. Mainly concentrated in the southeast, generating somewhere around 50,000 direct jobs and 250,000 indirect jobs, and $ 4 trillion will be added in the global pharmaceutical market in the next five years. In Brazil, the pharmaceutical market is $ 10 Billion, which gives Brazil the 9th place, boosting the number of generic. (Abifarma, 2012)
3. METHOD.

The method used in this study followed the steps described in the flow below, which will be explained below.

![Flowchart](chart.png)

*Picture 1 – Representation of the used method*

3.1 – MULTIPLE CHOICE FORM CREATION.

To facilitate the process of collecting and organizing the data was deemed necessary to build a form, made in 2007 EXCEL spreadsheet with extension XLS in multiple choice format and explanatory text in accordance with the original content.

3.4 CRITERIAS FOR COMPANY SELECTION.

For this article the company focused and selected to participate in the study are located in Brazil (domestic suppliers) and are located in three links in the chain of pharmaceutical production, namely, the leading manufacturer, two suppliers of 1st layer, selected according to two criteria and main distributor chain.

We observed the first vendor that supplies the leading manufacturer with the item (Stock Keeping Unit - SKU) of greater volume of annual supply. In the case of all the items purchased, it was found that the packages are items of larger volume.

The leading manufacturer reported that approximately 90% of the packages are provided by national or multinational companies with units installed in Brazil.

Among the items of national delivery found that only one SKU is responsible for 26% of the total delivered volume. For this criterion was the provider this item was selected to take the survey forward this criterion.

The cost per unit was the way the second supplier was selected survey participant. The leading manufacturer informs that features 430 SKUs of raw materials, between items
containing the active drug and other substances necessary for the manufacture of products (liquids and solids) to be bottled or packaged. Among the 430 items, the manufacturer advises that local supply is 360 and 70 for direct import. The company also reports that among all SKU’s, the main item on the national cost concentrates 28% of the total cost of domestic raw materials. For this criterion, this was the respondent supplier.

3.5 SENDING THE FORM TO SELECTED COMPANIES.

Applied the criteria described above, e-mails were sent within 10 to September 12, 2012, directly to the main managers of production or operations of these units, a total of 4 messages self-explanatory with the attached form.

3.6 DATA COLLECTION AND ORGANIZATION

The responses were sent within 14 to 20 September 2012, being the leading manufacturer replied on the 14th, the supplier of the highest cost item Day 18, the distributor and the supplier on the 18th item 20th largest volume September 2012.

4 HIPOTHESIS TESTS RESULTS

The results show that among the companies studied the Manufacturer with higher cost was who had the best performance for the application of lean practices, with an average of 2.77. The distributor was the one who had the worst performance, with an average of 1.94. A possible explanation for these findings, particularly in relation to the performance of the distributor is the fact that there is enormous pressure to maintain high levels of finished goods inventory. In the absence of any distributor in the consumer products could migrate to other brands.

For the analysis of variance was observed that for the elements 4,5,6,7 and 9, there is no evidence that the hypothesis Ho can be accepted (p-value<α=0.05), so is no evidence there is alignment in practice the use of Lean principles and tools described by SAE J4000 for these elements.

For Element 8 (Product), it was found that there is strong evidence that the hypothesis Ho can be accepted, so there is alignment by companies participating in the survey on the use of Lean principles and tools described by the standard SAE J4000.
5- FURTHER CONSIDERATIONS

Results showed that in only one of the six elements described in standard four companies are aligned in the implementation of lean manufacturing tools, which shows strategic alignment only this component.

This study's main limitation the number of participating companies, only four. For a better understanding of the actual behavior of the supply chain as a whole recommends further sampling on the number of participating companies.

Another opportunity is verified examine the possibility of greater alignment between groups of companies in the same layer or check whether the alignment has distinct behavior between links in the chain, eg, manufacturer / supplier or manufacturer / distributors.

6 – REFERENCES


SAE. SAE J4000: Identification and measurement of best practice in implementation of lean operation. Warrendale, PA, Society for Automotive Engineers, 1999a.