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# Lean Information Management in Industrial Context: an Experience Based on a Practical Case

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**Abstract**

*The interest in the application of the Lean methodology to the administrative processes has been abruptly catching the attention of multiple managers. The need to reduce (direct or indirect) costs through the processes' improvement, not only productively but also administratively, is gaining even more weight for organizations. Thus, there are many companies which are starting to reflect on their processes and on a way of becoming more competitive and more efficient. Through the improvement of the management information mechanisms, it is possible to make processes more efficient so that they can release resources for other activities. This is the context in which this project emerges, which aims to improve a Logistics process (customer service), using a simple, objective and functional solution with an immediate response to the elimination of waste in a decision making process. Behind this implementation, there is a whole study based on Lean methodologies that help to understand the project, to identify the improvements and to structure its conception.*

**Key words:** *Information Systems, Lean, Logistics, Processes' Improvement*

## 1. INTRODUCTION

The excellence in the performance of logistics activities has become a powerful source of competitive advantage, partly because of its perceptible impact on customers. Companies have been competing more and more based on the orders' response, delivery or dispatch time. With the purpose of improving their processes, companies count on powerful Information Systems (IS) which have been gaining a bigger relevance throughout the history of logistics.

By analysing the current and more competitive market, there is a companies' need to develop positively to keep their customers satisfied. As a result, the organizations adopt new processes of information management or they improve the existing ones so that they can increase the ability to respond to customers and enable a more specific tracking of each need. According to O'Brien and Marakas [1] "no company can compete without information systems." A company that manages its information dramatically reduces the time spent on certain tasks, which translates into cost savings. On the other hand, and in order to improve their performance, many companies have turned to lean manufacturing, which seemed to be an ideal solution [2]. Therefore, organizations are starting to support themselves with tools which cause a positive impact on the processes' efficiency. In this article, it is highlighted the Lean Management which has excellent results on the shop floor, as well as the management information process that is a key requirement to help improve business processes through the maximization of the information value.

The concept of Lean was created in 1990 by Womack, Jones and Ross [3, 4]. It appeared in the car industry, specifically in Toyota as Toyota Production System.

Lean "is a production practice that considers the expenditure of resources for any goal other than the creation of value for the end customer to be wasteful, and thus a target for elimination; basically, more value with less work". [5]. It is based upon the continuous improvement which offers the possibility to improve the companies' results where all the levels of the organization are involved [6].

On one hand, waste can be defined as "an unnecessary interruption, lack of coordination, unnecessary work or redundancies that do not add any value to the customer" [7]. By eliminating waste, the levels of competitiveness can be better reached and "when we make things flow in a constant and effective way, we dramatically gain market share to the competition" [7].

Due to its achieved benefits, the Lean methodology has become a management reference worldwide being currently applied in many activity sectors, without excluding the field of information management [3, 4]. According to Hill (1995) cited in [8] and Crute *et al.* (2003) cited in [8], "this methodology has become accepted by academics and practitioners as the dominant approach in manufacturing management. Its applicability and diffusion in industry has become so pervasive that some have even suggested that lean may soon become a ‘qualifier’ rather than a source of competitive advantage”.

Although the majority of literature associates the Lean techniques to productive processes, some studies have already shown the possibility of use this philosophy in the elimination of waste in other type of processes through the application of techniques that allows maximizing the information value due to the way how it is organized, visualized and represented [3-6].

On the other hand, Hicks [3] states that the Lean’s principles, specially the elimination of waste and seek of perfection, can be applied to any process where the product is ‘pulled’ by the customer, just like it occurs in the information processes.

Even though there is a lot of literature about Lean methodologies, there is not a book of recipes that explain each stage of the Lean process, not even one about the way to use these tools [9]. Each case is singular and for that reason all tools must be adapted to each reality. The involvement of all the management to change is considered to be a important requirement for the implementation of this philosophy. The Lean Philosophy involves all the collaborators in the process and encourages them to continuously improve their workstations. Who better than the person who daily performs a task to tell what he/she can do in a different way? In contrast, the opinion of people who never performed this task can also be valuable, as they can identify improvements harder to be recognized by those who are too far involved in the process (a fresher point of view).

Based on the improvement of processes, this project aims to improve the wasted time and the human resources performance related to a decision-making information process in the Logistics field of an industrial company with an international scope. Due to the constant changes in the market as well as the necessity to keep an accurate management of the processes to decrease the stocks and reduce lead-times, the logistics department had the need to create information mechanisms that enable the response to the challenges of the production planning in a more assertive way. The solution is based on the creation of a technological tool to support the analysis of forecasts, eliminating the existing oscillations of the orders that usually affect the production planning.

## 2. THEORETICAL BACKGROUND

After knowing the Lean philosophy as well as its benefits to the industry, the same principles had been quickly replicated in other sectors and the benefits were equally significant. According to Pat Quinn, VP of information systems and technology of Acuity Brands Lightning, cited by [10], “the elimination of waste is not applied only to scrapyard….it can also mean eliminating the waste of intellectual capital, human resources or anything else”.

The adaptation of the Lean concepts to other fields, beyond the traditional areas of manufacturing and production, may seem a broad concept at a first sight. However, and in accordance with some authors that has already implemented this methodology, the lean philosophy can be beneficial to any other area where processes can be mapped, the objectives can be measured and the resources are managed [4-6, 10].

Regarding the particular cases of IS area, the information management is a very important field and so it requires a lot of attention [1, 3, 11]. According to Pereira [11], wrong, delayed and/or distorted information can be source for serious problems within a supply chain. Oftentimes these problems stem from other factors such like inadequate information management process, inadequate integration of IS in business processes, technological infrastructures inoperable, among others. Linked to this area appears a new concept in literature: Lean Information Management (LIM) which is defined as an approach to improve organizational systems by reducing waste and drive up value of the information. According to Ibbitson and Smith [12], LIM focuses on establishment of roles, practices and responsibilities to manage the value of information.

So, to be possible to define standards and stabilize and improve processes, it is necessary to reduce the inherent waste. To reduce waste, it is necessary to identify it, so it should be clearly understood who the customer is and what he wants. If certain step/task is performed but it does not bring added value to the process, with the concept of customer satisfaction in mind, it should be improved and its waste reduced. When the subject is information processes, this may actually mean to eliminate a certain stage of the process.

This is why it can be already found in literature types of waste in the processes. Regarding Lean and types of waste found in manufacturing and production area (more specifically in the shop floor), most authors that work in this area are unanimous about the definition of seven types of waste: [2-3, 7]:

- **Transportation:** unnecessary movement of material, for example when the product is in course, it is moved from a process to another (with load).
- **Movement:** it refers to all the movements, whether from the operators or from the resulting products of the inefficiencies of layouts, rework, excess of production and stock (empty)
- **Scarp/rework:** extra operations from the defected parts, stock and excess of production.
- **Excess of Production**: more production than anticipated. This translates in excess of parts, anticipated production and stock increase.
- **Waiting time:** periods of inactivity throughout the process. This classification is used when the activity does not bring added value.
- **Stock:** product that does not satisfy the customer’s orders in that moment. The stock implies an extra occupation of space and resources. This can be raw material, product in course or final product.

- **Defects:** parts with non-compliances that cannot be sent to the customer. It may result in the customer's dissatisfied.

However, when the subject is data/information and the process is information management, *i.e.*, LIM, the identification of waste is not easy to understand, since waste is not visible and/or tangible as when compared to production and factory floor in a manufacturing context.

In IS area the waste may include the effort necessary to overcome difficulties in retrieving or accessing the information, the activities required to confirm and correct inaccurate information, and in extreme cases, damage to other processes that require information and the same is easily and quickly accessible [3]. According to Hicks [3], this lack of understanding and comprehension of waste associated with IS is one of the main barriers to a successful implementation of LIM. There are some studies that adapt 7 types of waste found in the production to the waste associated with information management. Hicks [3] presents four types of waste which can be applied in a similar way to the information systems: flow excess, flow demand, failure demand and flawed flow, which correspond respectively to the excess of production, waiting time, scrap/rework and defects. On the other hand, according to this author, it is not possible to make a direct analogy with the remaining three types of waste when the subject is advanced IS (digital systems, for example). Still, there are other authors [12, 13] who apply the same concepts to both cases when it is about simpler information systems.

In this way and by defining waste to the field of information management, there are:

- **Transportation:** approval of documents requiring more than one signature, to move files between folders.
- **Movement:** empty movements to get information. For example, all given steps until finding the information in a specific folder of the computer or the movement of people to get certain information.
- **Scrap/rework:** defects associated with inaccurate information, for example, coming wrong data or saved files in the wrong location.
- **Excess of Production:** to generate files / data / reports to which the process' customer will not use immediately.
- **Waiting time:** periods of time without an added value that when used it has no effect. For example, when there's the need of waiting for a program to run or for information to arrive from third parties.
- **Stock:** stock of office material, emails not read of the inbox (it complicates the research), too much information accumulated in paper.
- **Defects:** errors in data input, rewrite a report, reprocess an electronic transaction.

After the definition of the main types of waste and its analogy to the information management process, it becomes necessary to describe the used methodology for the case study of this project, which will be considered in the next chapter.

## 3. METHOLOGY

All the carried out study is based on a problematic of information management processes that involve the creation, representation, organization, visualization, reuse, sharing and communication the information useful in decision-making process in the Logistics field of an industrial company.

In a primary stage, the problem was analysed so that the existing gaps on the current process could be understood. For this, it was used the SIPOC (Supplier, Input, Process, Output, and Customer) methodology which allows to structure the process and consequently to understand where the information comes from, where it is going and what it is intended at the end, in terms of results [14]. The SIPOC methodology allows a high-level view of process, *i.e.*, a visual map of a process from end to end, usually used on Lean Six Sigma. It is the simplest and clearest way of understand a process, namely who is involved, what stages are being contemplated, and what is tangible and intangible. This analysis in shape of table is built on five specific points [14, 16]:

1. **S**uppliers – the one who gives the input of the process. It may be a person or an organization;
2. **I**nputs – it is a resource of the process; the basis of work;
3. **P**rocess – set of steps/tasks/actions that are led to the transformation of the inputs (in outputs);
4. **O**utputs – result of the process;
5. **C**ustomer – the one who enjoy the results of the process (person/organization); who receives the products/services.

In this matter, by distributing all the steps inherent to a process, it can be understood who is involved in the process, its dimension and it can be analyzed if the process's output meets in fact its needs. On the other hand, this tool uses other ones as a support, mainly for the process's performance. It can be designed as a VSM (Value Stream Mapping) or through a simple flowchart. The most relevant thing is to analyze the process and identify the improvement points to clearly understand which of the advantages of choosing this shape are.

To complement the SIPOC methodology in preliminary stages of development project, a pre-implementation questionnaire survey was applied to the actors involved in the process, so that their openness to change could be understood, and at the same time the users' needs and requirements were consolidated. A workshop also took place in the scope of the requirements elicitation.

Given the type of the problem, the solution was implemented using a visual basic on databases in MS-Excel. At last, and to understand the acceptation and impact of the new solution, an after-implementation questionnaire was applied to a population of twelve collaborators, eight of them were part of the team of Management of Customers and the remaining four were from Production Planning.

Relating to the development process, it was was based on an iterative and incremental model, around the *Plan-Do-Check-Act* (PDCA) cycle [15], that is divided in four stages:

1. **P**lan: to analyse the problem and define the plan of action;
2. **D**o: to implement these actions;
3. **C**heck: to verify/evaluate the implementation of the actions;
4. **A**ct: to act to improve the process in accordance with the results.

This cycle assumes the constant improvement of the processes because after the last stage, a new one begins.
In the next chapter, it will be possible to verify the practical application of all the methods described in this section.

## 4. PRACTICAL CASE

As already mentioned, this study is based on the application of Lean philosophy in an information process of the Logistics field, in order to improve the representation and visualization of the information, as well as its sharing and communication. In this chapter, it will be described first scenario (found scenario), the critical elements (waste) and main lean principles associated with its elimination, and finally, it will be described the proposed solution which has been accepted and implemented by the Organization.

### 4.1 **Analysis of the found Scenario**

To manage the information of the business process studied, the Organization uses two different IS: the first (named in this work as IS-a) provides information about fixed orders; the second (IS-b) generates information about sales' forecast. The fact that these two ISs operate independently and allied to the impossibility of data crossing automatically caused the existence of waste in the process of information. In particular, time waste in the manual crossing of data, contributing to a 'dilatation' of the response time. Indeed, the absence of appropriate tools to respond to certain need of the organization was confirmed by the respondents in the moment of the application of the first questionnaire. Due to this need, a solution to allow the elimination of waste motivated by the present systems was studied. As result, a technological tool to solve the problem and adjust to the needs of everyone involved in the decision process was implemented.
To understand the gaps, in a first stage, it was made a detailed analysis of the found scenario and its waste, using a SIPOC methodology, table 1 – stage "Plan" of the PDCA cycle".

**Table 1.** Application of the SIPOC to the found scenario.

| | |
|---|---|
| S | Order Desk |
| I | Customer's orders<br>Customer's forecast |
| P | Flowchart below (figure 1) |
| O | Estimated needs per month<br>Behaviour of the market in short-term<br>Data in a monthly base (without details) |
| C | Production planning |

Overall, the process can be translated as a log of orders and forecasts in the SAP systems, extraction of data, obtained results and a confrontation of results (with the production planning), see figure 1.

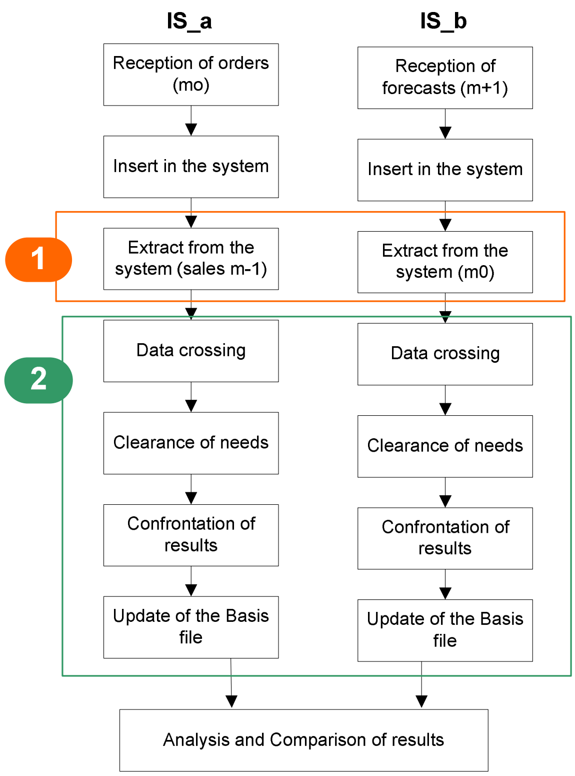


**Figure 1.** Flowchart of the found scenario's process.

As can be seen from figure 1, the analysis of this scenario is made in very general terms, *i.e*., it returns the results in one month period and consequently the drained conclusions are very limited. With this detailed representation and the consequent analysis, it is possible to understand where it is possible to reduce waste from the process. Therefore, two fields of improvement were identified, 1 and 2 (see in figure 1). Regarding the field 1: the involved steps are repeated three times (once for each type of product). If the data is extracted from SAP, why not extract everything at once. On the other hand, in case 2, apart from having repetitive tasks, the process is highly dependent of the human resources who perform it. Therefore, if data is being processed manually in Excel, there is a high chance to optimization the process.

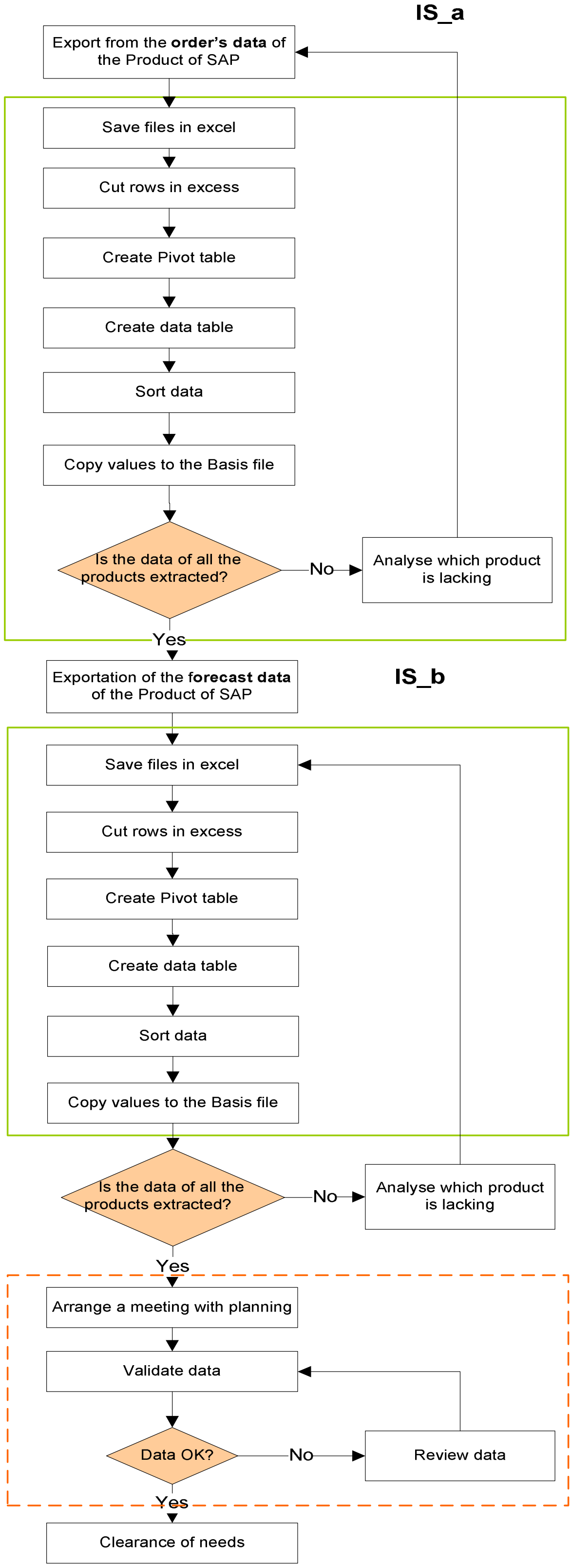


**Figure 2.** Detailed flowchart of the found scenario's process.

This type of analysis leads to the conclusion that this process has a huge potential of improvement and so it is necessary to clearly identify waste associated with it.

So, it was designed the flowchart of the process which begins in the field of improvement 1. By analyzing the presented flowchart (figure 2), there is a repetition of steps and that all the process repeats itself until a compilation of data of the three products (related with orders and forecast).
So, the waste found was identified in table 2. Table 3 shows the result of the application of the SIPOC methodology.

**Table 2.** Identification of waste.

| ***Found Scenario*** | ***Found Waste*** | ***Aims*** |
|---|---|---|
| The need to cross information of two different systems | Reduction of the waiting time<br>Reduction of movements | Use only one system |
| Monthly analysis | Reduction of transportation<br>Reduction of the rework | Allow a weekly analysis |
| Detail of only the macro analysis | Reduction of the waiting time | Allow the detailed analysis of each sector (reference) |
| There is no perception of the bestselling references | Reduction of the information excess | Allow a perception of the "A"* references |

**Table 3.** Application of the SIPOC to the future scenario.

| | |
|---|---|
| S | Order Desk<br>*Customer* |
| I | Customer's orders<br>Customer's forecast |
| P | Flowchart below (figure 3) |
| O | Estimated needs for six weeks<br>Behaviour of the market in short-term<br>Data in a monthly base<br>Reference's analysis<br>Customer's analysis – what are the oscillations between forecasts and orders? |
| C | Production planning<br>Production<br>Purchases |

After the analysis to the found scenario, it is possible to conclude that one of the points that should suffer some changes is the process's output. Therefore, the goal is to change the basis of analysis: on the found scenario, the data is based on a monthly basis and it is intended that with the implementation of the new solution, this moves to a weekly basis. Although it may appear to be just a detail, this change will allow the later analysis to be made, for each case and in real time. With this, the actions will be taken on the application of the event and not just at the end of the month. Although it may appear to be just a detail, this

* "A" References - References/products more sold over a given period

change will allow the later analysis to be made, for each case and in real time. With this, the actions will be taken at the time of the occurrences and not just at the end of the month.
There are areas that were also affected by the process and were not being considered. For example, the case of production that suffers with the changes to the plan, because it was estimated a quantity and, in reality, it is fixed as other order (bigger or smaller impact); and the purchases because it is estimated to buy a certain quantity and later is another one. As it can be seen, this process is much wider and it has an impact in more areas than it was initially thought. As a result, the advantages of this application are starting to be visible in a short-term and long-term.
On the other hand, for the analysis of this second stage of the process, it was considered one more provider of the information: the customer. The customer provides the information as an external source. From that moment on, all data is provided internally, by order desk.
Finally, the joint of the processes that occurred previously in an isolated way was considered. There are not two separated processes that cross each other in the last stage anymore. The aim was to process data since the beginning (figure 3). This little step is a huge saving in terms of time (hours) and human resources.
It follows that the objective is to make the process more lean, less complex in terms of data processing, and in the end return results to trigger specific new analyzes, if appropriate.

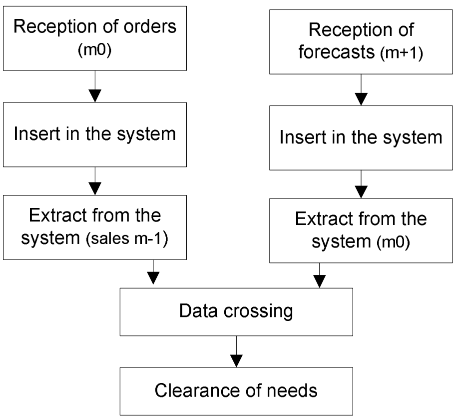


**Figure 3.** Flowchart of the future process.

## 4.2 **Proposed solution**

To smooth the waste caused by the previous system, it was created and implemented a technological tool that integrate information coming from the two systems presented before (IS-a e IS-b), providing information in an immediate and updated way and in the moment when it is necessary to the decision – stage “Do” of the PDCA cycle.
After the implementation of this solution, the process was clearly simplified (figure 4.). In this moment, there is an improved system with the tasks without added value largely reduced, of easier use and with results adjusted to the existing needs within the company.

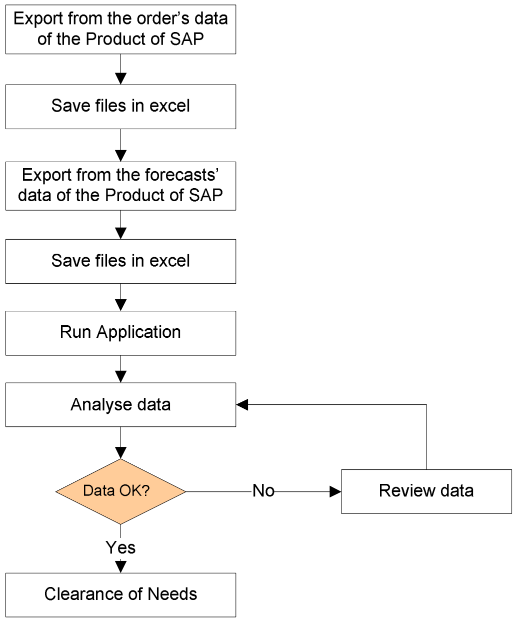


**Figure 4.** Detailed flowchart of the current scenario’s process.

The new solution allows presenting the variations which occur in the quantities of two consecutive moments of analysis (forecasts and orders), through a visual signposting of colours and easily perceptible by the user. With this signposting, the manager can easily recognize the data value, establishing priorities in the analysis and, consequently, gaining time in the process of the decision making. Another particularity of the solution is the detail of the analysis, giving the possibility to the user to *drill-down* the presented results, exploring all the data.
Figure 5 shows the example of a human interface, where the user has two options. Firstly, by clicking on the ‘A’ button, the user can update all the data to prepare the analysis. After, by clicking on the ‘B’ button, the analysis is automatically started by the application.

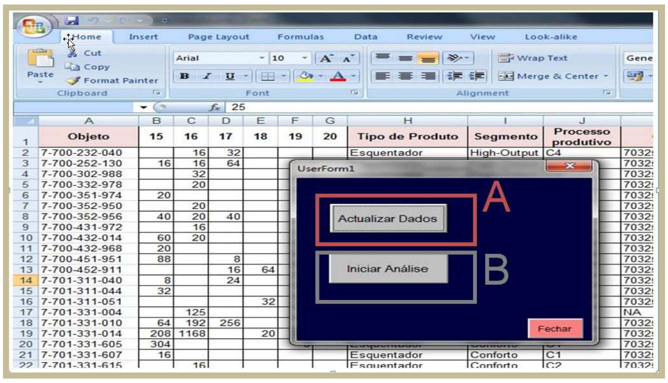


**Figure 5.** Example of User Interface of the application: update and data analysis.

As it can be seen, the data should be updated in an initial stage and then the user can proceed to the analysis of the results.

This mechanism is coded using visual basic and is based on a data reading process of existing ISs (IS-a and IS-b) automatically, building a set of reports which will support the decision process on orders that usually affect the production planning and the production.
In the figure 6, an example of analysis that could be made is shown: it begins with the choice of product to be analyzed, browsing between tables to reach the intended detail.

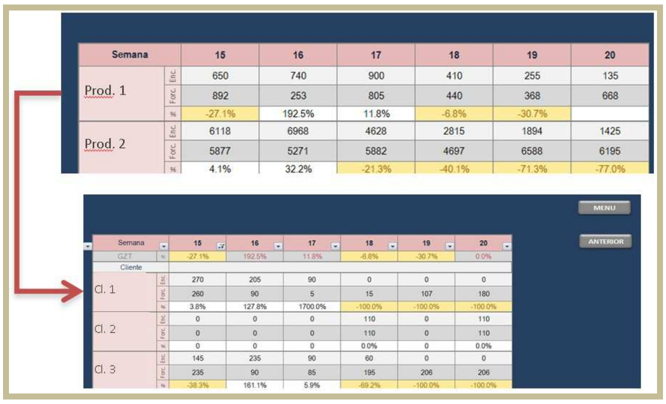


**Figure 6.** Output example of the application: detailed information for customer.

### 4.3 **Analysis of the Results**

After the implementation of the new solution in the studied organization, it was applied a survey to evaluate the impact of the solution. The results of the survey at this stage revealed very positive attitudes, with unanimous opinions among the respondents regarding the success and utility of the new tool – stage "Check" of the PDCA cycle.
In addition to the interest of the application and simplicity of the process after the implementation of the optimizations it was possible to reduce by 50% the human resources needed to this task, because now these are available to perform a significant reduction in terms of time (hours) of the task – about 87,5%.
However, there is the possibility in a near future that the organization expands the SAP solutions in certain fields to these questions where this project built. In this domain, an excellent work basis for this potential SAP adoption was made – stage "Act" of the PDCA cycle.
On the other hand, the productive field will enjoy in a medium/long-term the returned results by this application. By the comparison between orders and forecasts, the big and existing oscillations can be understood and through the historical of critical cases, the corrections to the system can be made. In this way, it becomes possible to level the production. With more reliable data, the production plan will suffer fewer changes and there will be a close contact with perfection (produce the right part, in the right quantity, in the right time, and with the right quality).
Moreover, the success of this application implementation is due in part to the collaboration of all the involved parties. All collaborators were quite involved in the process and showed openness and willing to change and improve.
Also be noted that, the success of this project is due in part to the collaboration of all the involved parties, because all employees understood the need to improve and showed openness to this change.

## 5. CONCLUSIONS AND FUTURE WORK

Projects related with the implementation of integrated solutions, for example SAP, are usually lengthy projects. Thus, intermediate solutions to solve immediate problems need often be achieved in industrial context.
The present project not only built a simple, objective and functional solution with an immediate response to the elimination of waste in a decision making process, but also became the preparatory basis to a potential adoption and implementation of SAP solutions. With this, it was possible to show that the Lean methodology can also be applied to administrative processes. As a result, the developed tool allowed establishing standards in the process.
It was highlighted another point related to the implication of all the collaborators since the first stage of the process, encouraging the concept of continuous learning.
It can be also concluded that, through a secondary process's analysis and improvement like management information process, there may be improvements in other organizational areas, more specifically, through the leveling of production, in the scope of the production field where there can be many medium/long-term advantages. This could translate in savings in terms of costs to the company.
As a last idea, it is believed that it is wise to emphasize the importance of the analysis to the administrative processes and in what way the existing methodologies can be useful and can add value to other types of processes when applied. In this case study, many tools of the Lean methodology were used to improve on administrative process through informatics tools which shows that the solution to be applied can often be simple to create and it is at the disposition of all companies.

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# Lean informacioni menadžment u industrijskom kontekstu: iskustvo zasnovano na praktičnom slučaju

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Primljen (23.03.2014.); Recenziran (24.06.2014.); Prihvaćen (02.07.2014.)

**Rezime**

*Interesovanje za primenu Lean metodologije u procesima administracije naglo je privuklo pažnju menadžera. Potreba da se smanje (direktno ili indirektno) troškovi kroz poboljšanje procesa, ne samo proizvodno već i administrativno, dobija još više na značaju za organizacije. Stoga, postoje mnoge kompanije koje počinju da razmišljaju o procesima i o načinu kako da postanu konkurentni i efikasniji. Kroz poboljšanje menadžerskih informativnih mehanizama moguće je učiniti procese efikasnijim tako da mogu da oslobode resurse za druge aktivnosti. Ovo je kontekst u kome je ovaj projekat nastao i čiji je cilj da poboljša logistički proces (usluge klijentima) koristeći jednostavno, objektivno i funkcionalno rešenje sa momentalnim odgovorom za eliminaciju viškova u procesu donošenja odluka. Iza ove primene, postoji cela studija zasnovana na Lean tehnologiji koja pomaže u razumevanju projekta, identifikaciji poboljšanja i u postavljaju strukture koncepta.*

**Ključne reči** *informacioni sistemi, Lean, logistika, poboljšanje procesa*