

Applicability of the Lean thinking in bakeries

Aplicabilidade do pensamento enxuto em Padarias

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ABSTRACT:

How Micro and Small Enterprises (MSEs) of the bakery industry in Brazil can become more competitive by adapting the Lean thinking is one of the core concerning problems that has been considered in this research. At first, 9 bakeries were analyzed. Then, one of them was chosen to experience the Lean transformation. The results showed that Lean still is not a well-known concept in this business segment. The bakery which applied Lean, reduced the operational costs and increased the net profit by around 25,96%, growing its profit margin ratio from 12.07% to 15.33%. **Key words:** Lean. Lean thinking. Bakery. Micro and Small Enterprise. MSE.

RESUMO:

Como Micro e Pequenas Empresas (MPEs) Brasileiras da indústria de panificação pode se tornar mais competitiva através do pensamento enxuto é o principal problema de pesquisa considerado neste estudo. Primeiramente, 9 padarias foram analisadas e em seguida, uma dessas foi escolhida para experimentar a transformação Lean. Os resultados mostraram que o Lean ainda não é um conceito bem conhecido neste segmento de negócio. A padaria que aplicou Lean, reduziu os custos operacionais e aumento o lucro líquido aproximadamente em 25,96%, elevando sua margem de lucro de 12,07% para 15,33%. **Key words:** Lean. Pensamento enxuto. Padaria. Micro e Pequena Empresa. MPE.

1. Introduction

The term Lean has been derived from a Japanese company named Toyota, where Eiji and Taiichi Ohno realized its importance and thus introduced the TPS (Toyota Production System). Their work about the limited productivity of mass manufacturing led them to think about a new approach of this subject (Ohno, 1988). The concept on which the modern conceptual framework of Lean is based on (Holweg, 2007).

Lean essentially takes the approach of reducing associated cost of manufacturing by means of

improved process efficiency. The goal is to minimize the cost by adapting to an approach where efficiency will ensure optimal use of resources where cost reduction yet improved quality will be a logical sequence (Yang, Hong, & Modi, 2011). The adaptation to the lean manufacturing enables a company to cater for added varieties of product range where the cost of the waste is eliminated which subsequently improves the overall profitability of the business.

The study conducted by Eroglu and Hofer (2011) showed that the lean production approach is specifically beneficial for the small industries compared to their medium and large counterparts. By means of Lean, profit maximization can be done in such a way that cannot be easily copied by competitors which reflects the robustness of such approach. This is due to the reason that the approach of Lean production is rather based on the improvement of the way a work is carried out along with streamlining its associated resources. Thus, as Dubbridge (2011) explained, the Lean production, which takes an approach of making improvement at low cost or no cost, can be adapted by any company.

Despite having appeared in a Japanese automobile industry, the fundamental ideas of the Lean management had a global context and can be applied in companies of different sectors (James P Womack & Jones, 1994). Although within the last couple of decades Lean philosophy has been extensively used in large companies including the OEMs (Original Equipment Manufacturer) at the same time, as argued by Conner (2009), the smaller businesses were not addressed in the proper way. The low level of relevant literatures regarding the research on the suitability of the Lean philosophy for bakeries is one example.

Taking the bakery industry to investigate the impact and fruitfulness of such approach is worth due to the importance that the Brazilian bakery industry has towards the total economy. According to SEBRAE/ABIP (2009) there are more than 60 thousand bakeries in Brazil where the greatest part are Craft Bakeries. Bakery sector in Brazil is mainly made up of Micro and Small Enterprises (MSEs) and have a tremendous contribution towards national economy with around 1,66% towards the Brazilian GDP with a total of 779,000 direct jobs as well as 1.8 million indirect jobs (ABIP/ITPC, 2012).

The level of competition is very high and fierce in this business segment. Beyond that, the present economic crises and the increased operating costs faced by the Brazilian MSEs are another factor to consider where the efficient production approach like Lean can be very helpful. The added advantage of Lean philosophy lies within its capability to introduce modernization in any industry. Resulting in an improved process and state-of-the-art-technology. It also incorporates strengthen and robust supply chain management as well as supplier relationship that is very important for the Brazilian bakery industry growth and competitiveness.

The bakery MSEs in the Brazilian market need to find a way to overcome the challenge of the economic crises and operational cost increase (cost of raw components, energy and other resources), in order to keep them competitive to survive and to flourish. One of the definite means for achieving this objective is to be more cost-efficient and strategic in approach where cost reduction will be associated with quality assurance as well as flexibility. When this aspect comes into the light, the specific consideration of Lean production gets its own importance.

Research has shown that the industries suffering from such challenges that the Brazilian bakery MSEs are experiencing the adaptation to Lean helped to a great extent. Therefore, the main research questions are: Is Lean Manufacturing also directed to MSEs of Bakery Industry in Brazil? What would be the impact and associated factors? Can it effectively help this business segment become more competitive?

2. Theoretical background

Lean manufacturing is a system that creates maximum outputs with minimum input possible as presented by (James P Womack, Jones, & Roos, 1990). According to Naves (2002) , this approach showed to be more suitable and appropriate for this study since its implementation is

driving right at the bottom of the organizational pyramid, where most of the employees can be involved in the process.

The argument by J. P. Womack and Jones (2003) implies that Lean thinking has five fundamental principles: Specify Value; Value stream mapping (VSM); Flow, Pull, Perfection. Any organization wishing to implement lean manufacturing should understand the meaning of these elements and adapt them to the area of operation.

Another important concept is Muda, a Japanese word for 'Waste' that refers to anything that consumes resources and does not add value to the customers total experience. In a food business, as Bakeries, is easy to be seen in terms of wastage of materials. Since it appears in the waste bins and ends up in landfill sites as Dubbridge (2011) presented.

According to Ohno (1988) there are 7 kinds of waste: Over Production – making more than you can sell; Inventory – the total inventory essentially becomes waste unless they are turned into successful sales; Transport – any movement in the factory could be viewed as waste; Bad Quality - Creating products that cannot be sold or that must be reworked; Operator motion – this term refers to the unnecessary movements taken by employees or equipment; Idle Time - waiting for processing; Processing – operations or processing that may not be needed.

There have been numerous benefits of lean production as mentioned in the available literature. Lima and Zawislak (2003) highlight the gains in flexibility, reliability and the reduction of stock time. According to Buker (2013), they have experienced the following benefits while implementing Lean: 20 to 40% of production cost reduction; 40 to 60% of floor space release and reduction of inventory; 50 to 75% reduction of lead-time. All important improvement targets pursued by the Bakeries.

For identification analysis and subsequently solving problem within the manufacturing process, Lean approach is enriched with a number of embedded tools. As mentioned, Lean derived from the Toyota Production System (TPS), in the book 'Toyota Way', J. K Liker (2004) explains the fundamentals and in the book 'Toyota Way Field book', J. K. Liker and Meier (2006) present the main tools and a practical implementation guide.

It is worth mentioning here that Lean is not a mere toolkit. This is such a sophisticated system where all the elements in the system work in a holistic way to accomplish its goal. The whole at its roots focuses on supporting and encouraging people to continually improve the processes they work on.

Lean assessment is considered to be an initial step for the implementation of Lean Manufacturing. It is a methodology to determine the current status and leanness of the company and to identify whether the company can have the most impact and fastest payback both in the beginning and throughout their Lean initiative. Given directions to draw proper goals and a plan to achieve them are outlined within this context. There are different models, however, we chose the Lean Assessment model proposed by AME (2013). Considering the availability of the data and parameters to compare with other companies around the world, these assessment tools will allow determine if the studied bakeries already know some principles of Lean Manufacturing. And if so, how they are doing it.

James P Womack and Jones (1994) have argued that the fundamental of the lean management and production had a global context, which can be applied to any kind of business settings. However, due to the varieties of sectors and business models it is important to highlight that many papers came thought not just to validate its theory but due to the particularity of different process in different business. The way the implementation will took place can vary dramatically and can be decisive for the success or fail of the implementation. Otherwise, Lean can be misunderstood as another fashion that rapidly came and rapidly goes.

There are different frameworks and road maps for different size organizations and sectors to implement Lean manufacturing. Since we did not find one specific to bakery industry, we chose the model presented by Wilson (2010), due to its simplicity by comparing it as an implementation of any large project dividing the implementation process in the following eight

steps:

1. Assess Fundamental Issues to Cultural Change;
2. Complete a System Wide Evaluation of the Present State;
3. Perform and Education Evaluation;
4. Document the Current Condition;
5. Redesign to Reduce Wastes;
6. Evaluate and Determine the Goals for This Line;
7. Implement the Kaizen Activities;
8. Evaluate the Newly Formed Present State, Stress the System, Then Return to Step 1.

From the products commercialized within the bakeries in Brazil, the craft in house production of the bakery and pastry products correspond to 45% of the revenue. The Bakery Industry is extremely important for the Brazilian economy and not less is well represented by different institutions and organizations. Among the most important organizations responsible for developing the sector are: ABIP – The Brazilian Association of Bakery; IPTC - The Technological Institute of Baking and Pastry; SENAI - The National Service of Industrial Learning; SEBRAE - Brazilian Service of Support for Micro and Small Enterprises and others. Although Lean philosophy is not taking place, incorporating the product portfolio of a structured program to develop the business sector.

3. Methodology

This is an applied research, since it aims is to generate knowledge for practical applications to solve specific problems. It is a mixed method, since it combines quantitative and qualitative. From the point of view of the technical procedures, we adopted the Action Research (AR). This technique is a collaborative activity where encompasses the participation of the researchers along with the people involved in the process to be studied. It involves learning about one context through changing and improving it. It is usually used in real situations to solve real problems according to O'Brien (1998) .

Thus, we adopted the following research strategy:

- Sources of secondary data: After the literature review about Lean and MSEs Bakeries, we consulted associations and organized representatives of bakery industry;
 - Collection and analysis of data: We conducted visits and non-structured interviews with the owners or managers of ten bakeries in Belo Horizonte city. This was important, since it enabled us to capture negative factors for achieving the goals that often were not only perceived by the observations;
 - Conducted the Lean assessment based in the AME assessment methodology;
 - Implementation of Lean Manufacturing during four months in one bakery. This step focused on the process of the flagship product, and involved the realization of the theoretical and on the job training;
 - Data analysis;
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4. Results and data analysis

Ten bakeries, which fit the criteria of being MSEs located in the region of Belo Horizonte - MG, were considered for the study. Data was collected using face-to-face interviews and shop floor visit in all of the ten facilities in order to collect information on the leanness of their operations. This section involved observation and also the use of the AME lean assessment forms. The analysis and results of the AME lean assessment scorecard are shown in table 1. In average, the interviews took 40 min each while the facility visits took 1 hour.

Lean Enterprise Attributes		Bakeries										AME Lean Assessment Historic of 80 manufactory companies			
1. Management Support	5	0	0	0	0	0	0	0	0	0	0	1,78	2,32	2,25	3,70
2. Culture	5	0	0	0	0	0	0	0	0	0	0	1,65	2,30	1,98	3,55
3. 5S	5	0	0	0	1	0	0	0	0	0	0	1,18	2,10	1,80	2,93
4. Value Stream Mapping	5	0	0	0	0	0	0	0	0	0	0	1,17	2,14	2,30	2,28
5. Setup Reduction	5	0	0	0	0	0	0	0	0	0	0	1,14	1,54	1,10	3,13
6. Total Productive Maintenance	5	0	0	0	0	0	0	0	0	0	0	1,32	1,74	2,10	3,33
7. Pull Systems	5	0	0	0	1	0	0	0	0	0	0	1,38	1,93	1,98	3,08
8. Production Flow	5	0	0	0	0	0	0	0	0	0	0	1,31	2,00	2,33	3,43
9. Plant Layout	5	0	0	0	1	0	0	0	0	0	0	1,28	1,85	2,45	3,41
10. Standard Work	5	0	0	0	1	0	0	0	0	0	0	1,44	1,72	2,80	3,43
11. Lean Product and Process Design	5	0	0	0	0	0	0	0	0	0	0	0,91	1,13	1,30	2,43
12. Accounting Support for Lean	5	0	0	0	0	0	0	0	0	0	0	0,34	0,10	1,00	1,20
13. Supply Chain	5	0	0	0	0	0	0	0	0	0	0	0,79	0,64	1,50	1,60
14. Continuous Improvement	5	0	1	1	1	0	1	0	1	0	0	1,39	2,00	1,68	3,44
Lean Enterprise Score	5	0	0	0	0	0	0	0	0	0	0	1,22	1,68	1,90	2,92
Lean Enterprise Score %	100%	0%	1%	1%	4%	1%	1%	0%	1%	0%	0%	24,40%	33,57%	37,93%	58,48%

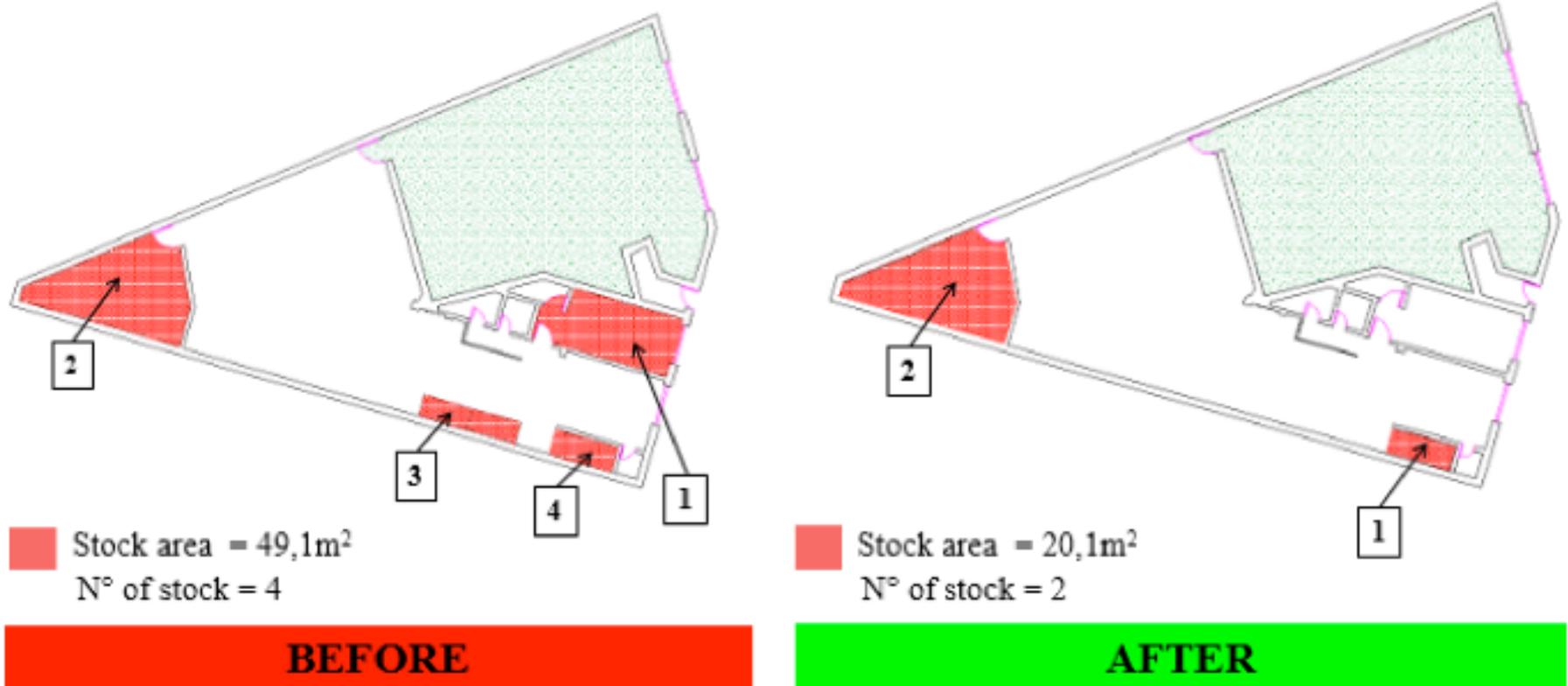
Source: Data of the study and adapted from AME (2013)

The second part of the study focused on the implementation of Lean principles, within a span of four months, at the bakery 'Pantrigo', due to the easy access to its information as well as the interest and willingness of the owners to cooperate and learn about Lean.

According to Domingo (2013), the steps to effectively eliminate waste are: - make waste visible; be conscious of the waste; be accountable for the waste; measure the waste; eliminate or reduce the waste. In this sense, according to Rother (2003), the first step to implement Lean is document the present state of Value Stream Mapping (VSM). The purpose is to understand the process and the main problems that prevent the company from achieving a high level of profitability. We started exactly at that point, mapping the current situation of the bakery "Pantrigo" elaborating the VSM of the flagship product, the French bread, identifying improvement opportunities.

Afterwards we started the 5S's program. Beyond the visual change the main benefit from the 5S's implementation was reducing the stock area by 59% as shown in Figure 1. This enabled the company to release 29 square meters of storage area, improved stock control and reduced the stock of raw materials and WIP in 35%.

Figure 1 - New layout with elimination of stock areas



Source: Elaborated by the authors

The third phase of the transformation process involved developing a sense of continuous improvement. The first Kaizen (improvement) that the company implemented was converting what was stock area one into a training and lunchroom for the employees (Figure 2).

Figure 2 – New training and lunchroom, instead of stock area 1



Source: Elaborated by the authors

One of the decisions made was that the ceiling of the processing area required immediate cleaning and painting to improve the aesthetics and hygienic of the area. Beyond that, more lighting was installed in the manipulation area enhancing the illumination, since it was too dark, making difficult the quality inspection.

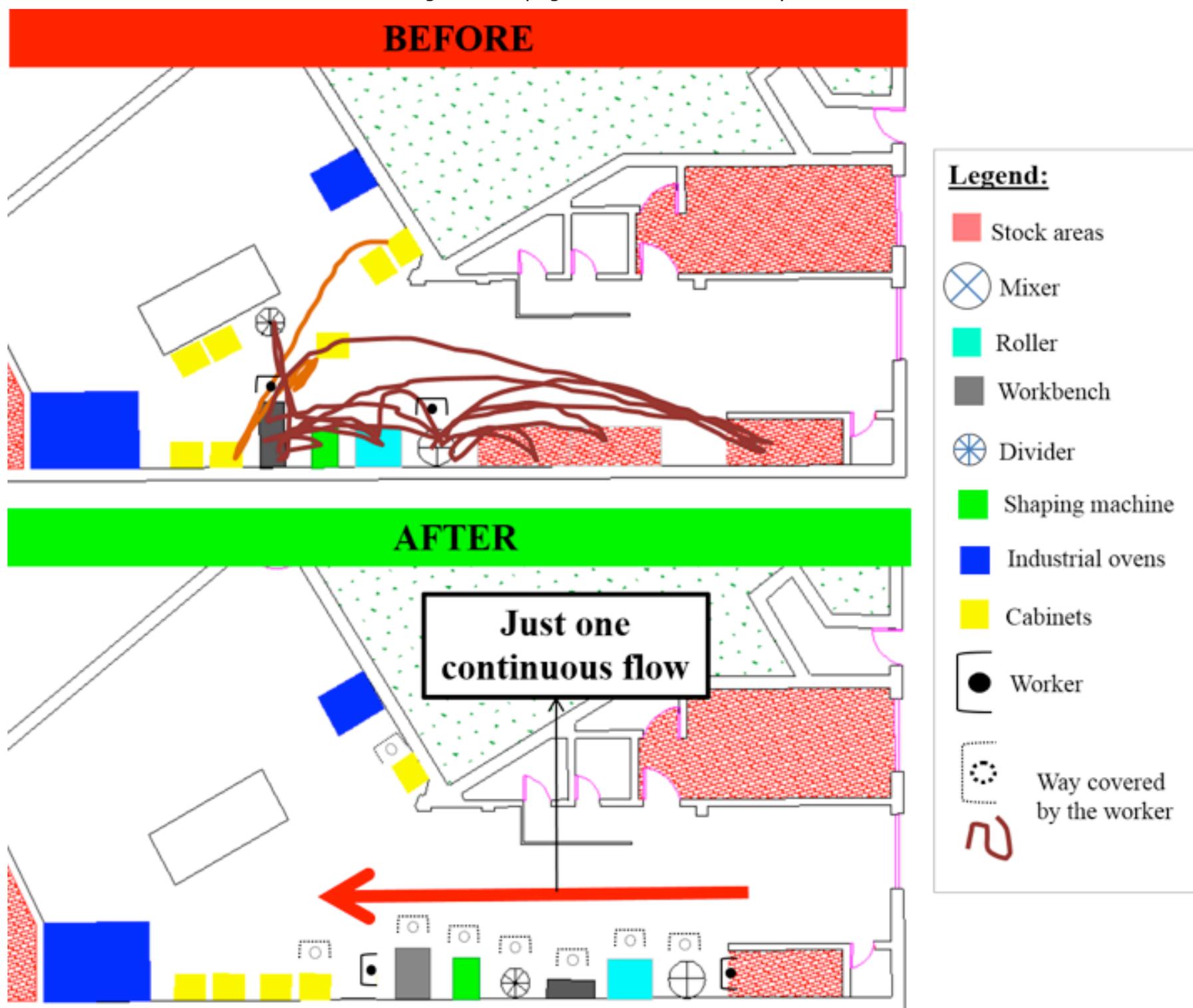
In order to improve the work environment further, we fixed the ventilation system and created an airflow passage for regulating the temperature change the exit gate and make it with grills that allowed airflow. The production area had extremely high temperature, which was not conducive to the employees. According to the employees, the result was significant.

In response to the idle time, while using the industrial ovens, the decision was to deactivate one of the three chambers in order to reduce electricity consumption and avoid the employees just let that turned on without using. The second step was to repair the Analogic timer in oven

number two, which had been non-functional for more than five years. With the timer working, it was possible to standardize the period for baking bread and other products. As a result, the baker assistant could undertake other activities as the products were baking and thus reduce idleness.

With the elimination of two stock areas, the company gained space, which enabled redesign and changing the layout of the production area. After some simulations, the layout in line was more appropriate. As the result, we eliminate mostly the WIP. Before the workers walked around 400 meters per shift while doing their activities in the new layout, it was reduced to only 80 meters on average. Another outcome was the reduction of the operation time of pre weighting from 15 to 11 minutes and the mixing operation from 50 minutes to 45 minutes (Figure 3).

Figure 3 - Spaghetti chart and new layout



Source: Elaborated by the authors

In the analysis, overproduction was determined as the key problem. Where the main cause was to be the poor production programming. The company production was only driven by a daily list of what should be produced, which was based on know-how and quickly visual analyses of the stocks. Mostly the bakers and pastry specialists decided by themselves what they had to

produce.

Since the company did not have available data, the real first step in this case was documenting the product mix and recipes of the company. We also established the batches, minimum quantities based on known tested variations of the recipes, classified and grouped the products by departments: pastry, bakery, refined bakery, sweets among others. We also created a production planning and control board (Figure 4) placing it in the production area where the spreadsheets for programming and historic were visible to everyone. We enhanced the visual communication even more by dividing the board in two parts one with the customer orders (make-to-order) and another based on the forecast (make-to-stock).

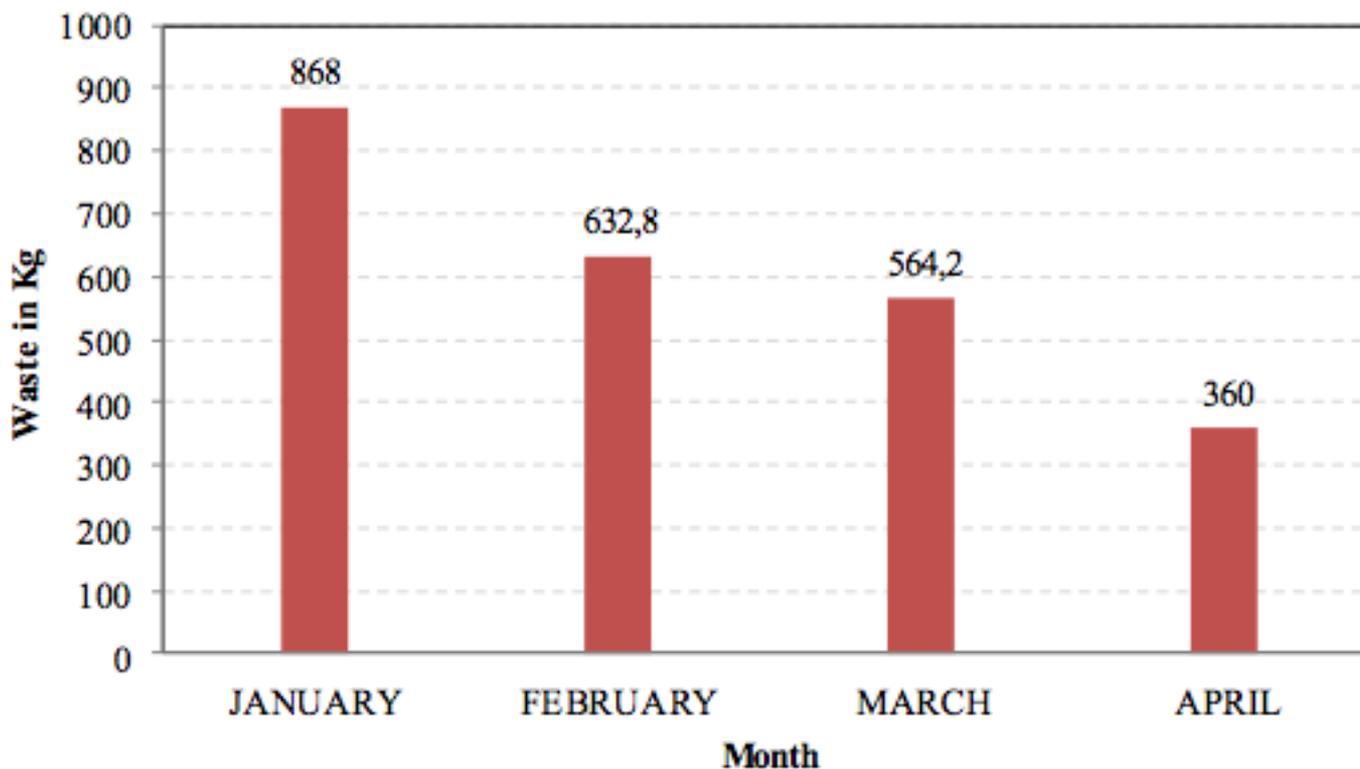
Figure 4 - Production programming board



Source: Elaborated by the authors

By introducing this production planning strategy, we eliminated waste and also contribute to standardize the production. We reduced the amount of garbage generated by the company mainly formed of bakery and pastry products in April by 508kg comparing January (Figure 5). It represents 58% less waste. Considering that the average price of bake and pastry products is 3.5 US dollars/kg, this represented a saving around 1,778 US dollars (508kg x \$3.5/kg).

Figure 5–Waste evolution of bakery and pastry products



An associated outcome after reducing the stock area was the rearrange of the production and the definition of a better way to planning and control the production that lead to decrease the stock of raw material and the lead-time of the process from 30 days to 8 days. They agreed that the risks were very low and that would not generate any additional costs for the company since the suppliers could deliver the goods every week.

After implementing Lean production for 4 months at the company "Pantrigo" we conducted a new lean assessment in order to reevaluate the leanness of the company. Based on the AME Lean assessment score system, the company in the analysis has improved from 0% to a lean enterprise score of 18,57% (Table 2) what were satisfactory considering only 4 months of implementation.

Following the income statement and the profit and loss statement, we evaluate the business performance during this period. The company has increased its profit by \$1,836 what represents an increase in its profit margin ration of 3,26%. If we compare the net profit of January with the net profit of April, the company has increased its profit by 25,96%.

Table 2 - Reassessment after Lean implementation

Lean Enterprise Attributes	Max. Score	Bakery "Pantrigo"		AME Lean Assessment Historic of 80 manufactory companies			
		Before	After	<1 Year	<2 Years	<3 Years	>3 Years
1. Management Support	5	0	2,5	1,78	2,32	2,25	3,7
2. Culture	5	0	1	1,65	2,3	1,98	3,55
3. 5S	5	0	2,5	1,18	2,1	1,8	2,93
4. Value Stream Mapping	5	0	1	1,17	2,14	2,3	2,28
5. Setup Reduction	5	0	0	1,14	1,54	1,1	3,13
6. Total Productive Maintenance	5	0	0	1,32	1,74	2,1	3,33
7. Pull Systems	5	0	1	1,38	1,93	1,98	3,08
8. Production Flow	5	0	1	1,31	2	2,33	3,43
9. Plant Layout	5	0	1	1,28	1,85	2,45	3,41
10. Standard Work	5	0	1	1,44	1,72	2,8	3,43
11. Lean Product and Process Design	5	0	0	0,91	1,13	1,3	2,43
12. Accounting Support for Lean	5	0	0	0,34	0,1	1	1,2
13. Supply Chain	5	0	1	0,79	0,64	1,5	1,6
14. Continuous Improvement	5	0	1	1,39	2	1,68	3,44
Lean Enterprise Score	5	0	0,93	1,22	1,68	1,9	2,92
Lean Enterprise Score %	100%	0%	18,57%	24,40%	33,57%	37,93%	58,48%

Source: Compiled from AME (2013) plus data from study

5. Conclusions

Despite its global context and applicability of Lean, the findings of the study indicate that those bakeries do not apply the Lean and that Lean management still is not a well-known concept at the Bakeries in the region of Belo Horizonte – MG. Few companies knew about some lean practices such as the "5S". Despite the bakery industry organizations in Brazil be active and offer different services, they still do not indicate Lean as part of programs to help in the development of this business sector.

We also identified the critical and particular aspects of the MSEs Bakery industry in Brazil that should be considered before implementing Len as: high workload of the owners and managers; low education levels of the owners, managers and employees; flat organization structure;

number of employees; high turnover; low profit margins; low investment capital; scarcity of workforce and skilled labor; Informality; low availability of data and the necessity to obtain short-term results. This suggests that a specific theoretical implementation framework must be further developed to help the implementation process in this business segment.

We also implemented lean manufacturing in one bakery and we confirmed that Lean can be applied to Bakery Industry and MSEs in Brazil despite the critical aspects that must be taken in consideration. We were able to implement different tools like: 5S`s, Kaizen activities, waste analysis and reduction, visual communication improvement and standardization. Even in a short-term implementation, Lean can give impressive results. In this case, particularly, the company was able to keep the gross sales reducing the operational costs increasing the net profit by around 25,96% and grow its profit margin ratio from 12.07% to 15.33% what suggests that the company has become more competitive and profitable.

In this sense, all the research questions were answered and the hypothesis confirmed. Lean has shown to be effective giving competitive advantages to MSEs of bakery Industry in Brazil and our suggestion is that it must be considered by the representative organizations of bakery industry in Brazil like APIB, SEBRAE, IPTC. This could be designed as a complete systematic approach to develop the business sector.

In addition, more case studies could be conducted concerning the implementation of the methodology Lean at MSEs of Bakery Industry not just in short term but in medium and long term range. Additionally, the participation of the researchers can be understanding as one of limitations of this study. Since it adds qualified human resource during Lean transformation. Then, it is also important analyzed the capability of the bakeries sustain the results, start or continue Lean transformation by themselves.

Another action that could be done is about deepening the study in order to develop a detailed roadmap and incorporate Lean in the portfolio of the bakery industry organizations in a national level in Brazil. Without support of the representative organizations, it seems to be unrealistic to overcome all the issues that regard lean implementation faced by the MSEs of the bakery segment.

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