LEAN PRODUCTION APPLIED IN A LARGE COMPANY IN THE BRAZILIAN PRINTING INDUSTRY

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ABSTRACT

The fundamentals of lean production and the results of applying these concepts in a large Brazilian printing company are presented. The results showed a significant reduction in process waste and a gain in productivity, with a notable reduction in operating costs and an increase in service agility.

Keywords: Lean production, printing company, reduction cost.

Introduction

Increasing demands from consumers, plus growing competition, has forced companies to refine their manufacturing practices. Since the beginning of the 1960s, this situation led Japanese firms in the automotive sector, in particular the Toyota Motor Company, to develop different methods of vehicle manufacture compared to those employed by U.S. industry, at a time when the model was Ford's mass production method. The concept of Lean Production then arises, not exclusively for Toyota, but as a concept applicable to companies in any type of business and in any country. It is seen as a business strategy to increase customer satisfaction through better use of resources.

No different than in other sectors, the Brazilian printing industry also faces inherent obstacles to production, and must improve to stay competitive. The company in which the study was conducted is a large enterprise in the printing industry, a market leader in its segment. The study was conducted in an area of the company responsible for collecting scrap paper. The application of lean production philosophy resulted in improved performance in this area.

Literature Review

Lean manufacturing or lean transformation is a term coined by a research group at MIT that promotes elimination of inventory and others forms of waste, shorter lead times and improve quality. Lean production combines the advantages of mass production without the high cost of inventory and other waste. Sipper and Bolfin (1997, p.52) describe that it is widely recognized that Japan was far ahead of the rest of the world in implementing lean production, with started in 1950s at Toyota. When compared with mass production system, lean production uses less human effort, less manufacturing space and less time to production (Sipper and Bulfin, 1997; Henderson and Larco, 2000). Lean production is an alternative

approach your company can take that will make life extremely difficult for your competitors.Waste elimination is one of the most effective ways to increase the profitability of any business.

The philosophy of lean production highlights seven important wastes that must be eliminated and five principles for guiding your implementation. Figure 1 shows the seven waste and the five principles.

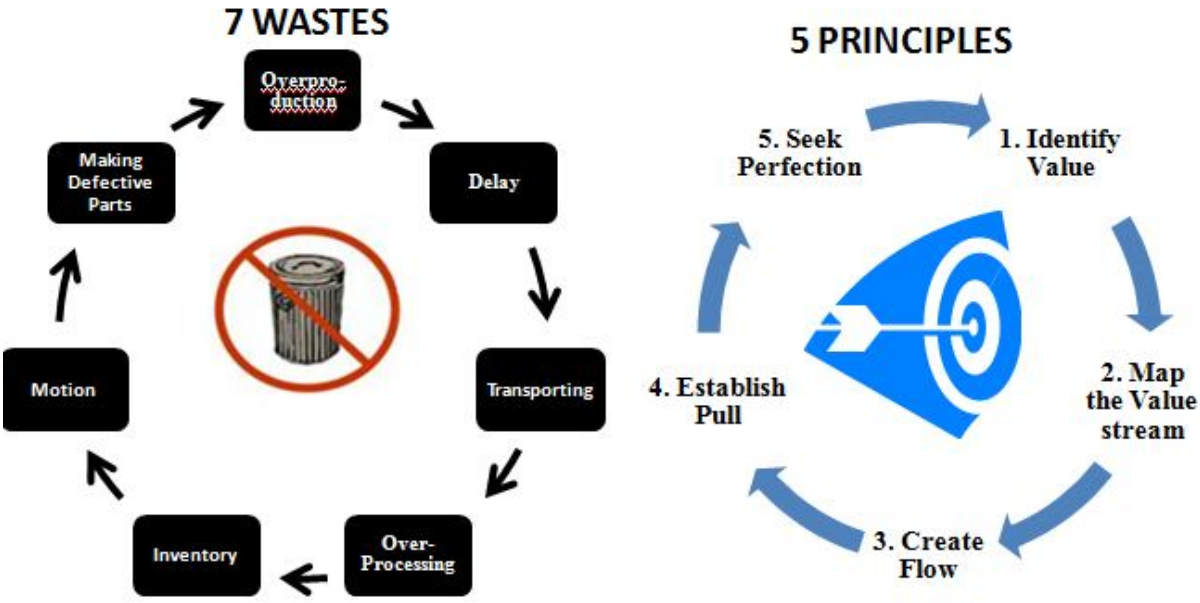

Figure 1. Seven Wastes and Five Principles of Lean Production(Adapted by Lean Enterprise Institute).

Methodology

To carry out the work was followed the steps:

A) Initial evaluation: A survey in the industrial area identifying the locations of better opportunity and more rapid return in terms of waste reduction and increased productivity. It was decided to develop work everywhere removal of scrap paper, since the withdrawal to the placement of scrap paper in buckets for sale

B) Workplace safety, order and cleanliness: Many problems with waste, quality and productivity are directly related to this issue. An unsafe, dirty and disorganized plant often has poor quality and several wastes. To improve the environment, we performed a 5S program. First of all, there was some concern about the acceptance of the program by the team. To neutralize this problem all employees were trained in the job. The figure 2 shows a training being held.

Figure 2. Employees being trained.

c) Key Points to improve: After House Keeping and "5S" system implementation, a survey was conducted in order to define the critical points that should be improved. It was verified that the critical point was related to moving of scrap paper, due to handling, identification and weight of the vehicles used to transport the scrap paper. These problems, in addition to the cost increase, causing health problems for employees. According to Table 1, it can be seen that the vehicles had inadequate measures and their capacity were varied. The distance between the ground and the base was very large was too large, which caused loss of internal capacity. They were also too heavy. Some vehicles loaded weighed 680.4 kg. As the movement was made by the worker, who was pushing the car over long distances, this was a strong cause of occupational health problems.

Table 1. Dimensions of transport vehicles.

Department	Width(m)	Length(m)	Total height(m)	Wheel height(m)	Volume (m3)
Preparation	**0,95**	**2**	**0,98**	**0,21**	**1,46**
Cut	**0,8**	**1,35**	**0,98**	**0,21**	**0,83**
Print	**0,8**	**1,5**	**0,98**	**0,21**	**0,92**

The vehicles took a long time to be weighed, especially for the delay in data collection by the operator who originally wrote the information on a sheet of paper and then enter into a spreadsheet that was subsequently reviewed by a second person. To transfer scrap paper to the bucket, loaded cars passed through a ramp made of steel plate as shown in figure 3. Another opportunity for improvement was on the placement of buckets. Due to limited space in this area, these buckets had to be placed in an exact space, which generated a long operation time, beyond the tread wear, because these buckets weighed over 20 tons when loaded with scrap paper.

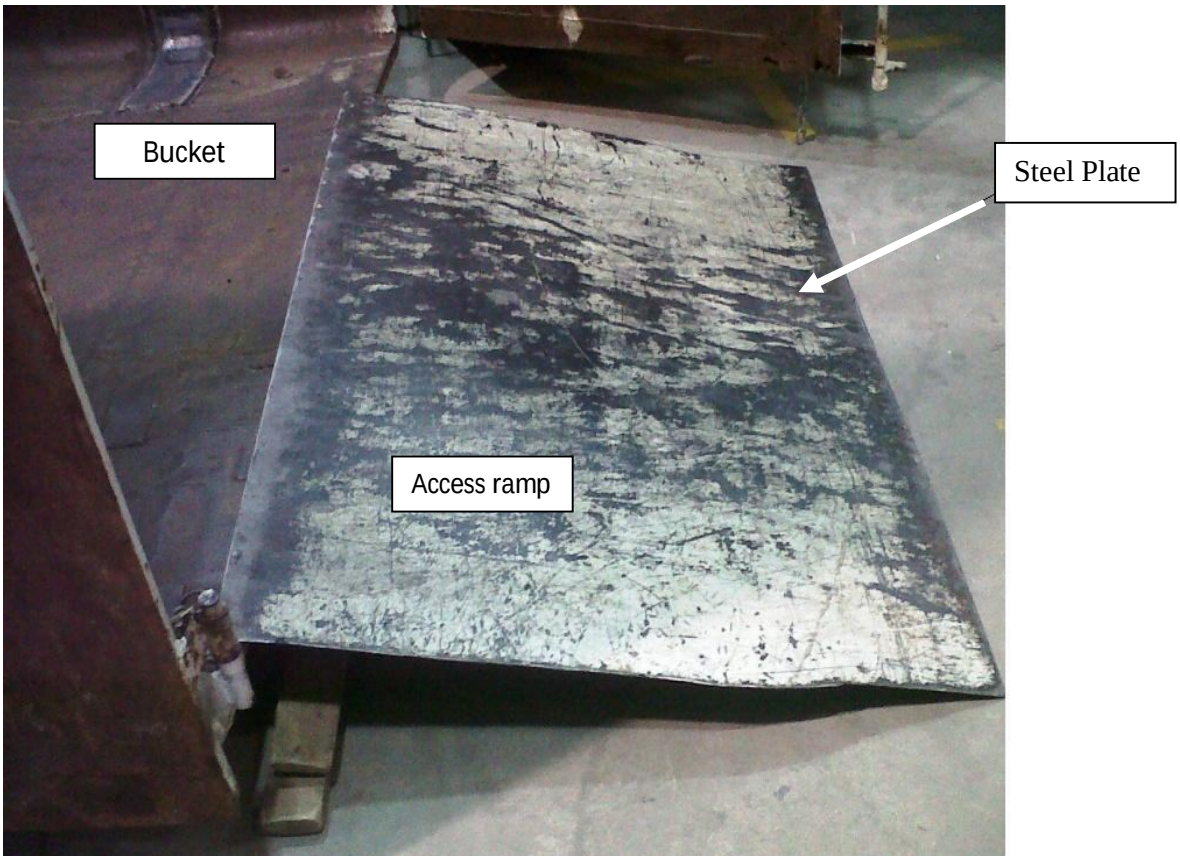

Figure 3. Access ramp to the bucket.

Results and Discussion

In order to improve the productivity and reduce the efforts of operators, it was propose a new design for the car as shown in Figure 4. In this new car, the height of the base from the ground was reduced by 47.6%, producing a saving of space provided an increase in volume of 50.6% and 35.9% compared to the old cars. Addition to the standardization of vehicles and gain in volume transported with significant reduction in tare weight of the car, it was decided that the site collects vehicles were associated with an identification placed in the car facilitating their identification by the operator who performed the weighing. Was deployed a new spreadsheet to record the data already with the weight of the car. Thus weighing already provided the net weight. In the spreadsheet used to concepts of *"poka-yoke"* in order to eliminate the possibility of operator error.

The height of the base from the ground was reduced by 47.6%, generating a volumetric increase of 50.6% compared to the previous vehicles. To transport the vehicles we started to use electric pallet. To facilitate its handling, is adapted at the bottom of the four sides of the square cars guides for introducing the fork of the pallet truck.

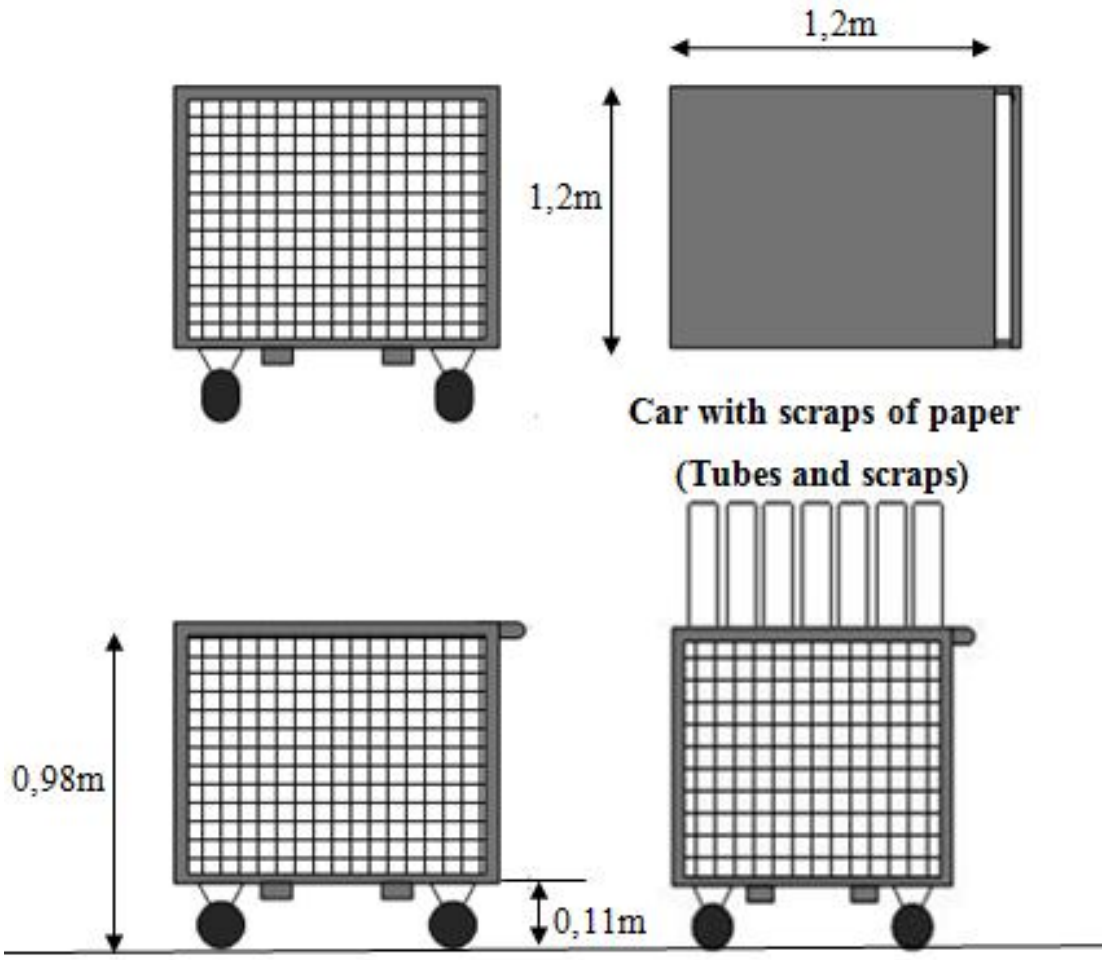

Figure 4. Design of the new vehicles.

To improve the ramp up to the bucket, it was changed the material of the ramp, going to use a checkered plate, reducing the risk of slipping the vehicles at the time of ascent. Figure 5 illustrates the new ramp. It also supports were placed so that the pallet could take the ramp and put in place more quickly so that its workers do this service.

Regarding the exchange of buckets, face to space be reduced, was adapted two plates on the ground to guide the truck driver. Besides this, were painted yellow guides for easy orientation. The Figure 6 shows the place.

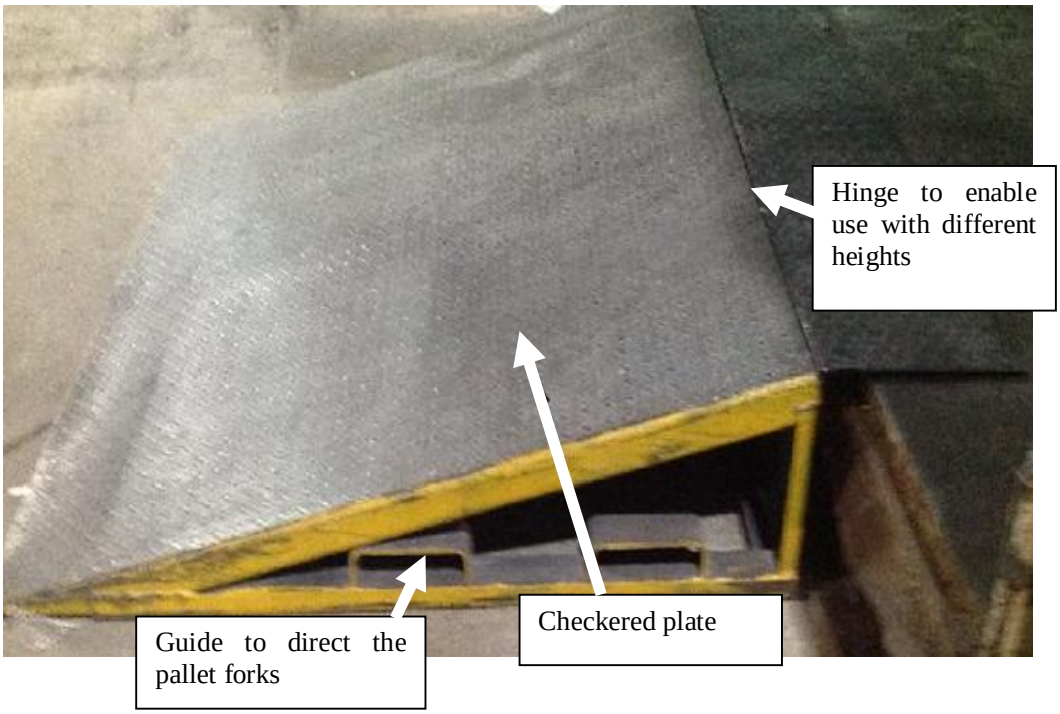

Figure 6. New access ramp.

Figure 7. New place for buckets

Cost Reduction and productivity improvement

After the implantation of the improvements, it was verified the following gains:
1) The time weighing the cars was reduced in average 80% by eliminating activities that do not add value to the process, in addition to data has become much more organized and reliable;
2) Reduction in mean flow of cars in more than 35%, i.e., from 204 to 132 trips per day due to the increased volume of cars;

3) The time of transport trolleys was reduced by 65% as shown in Table 2;
4) Reduction of labor, with a gain of six employees. The data are presented in Table 3.
5) Improvement in working conditions, according to the best ergonomics. This will likely reduce future occupational health problems, since they have become less physical effort, and work in more appropriate position.

Table 2. Evolution time to transport the cars

	Before the change	After the change
Rotating machines area	**122 s**	**43 s**
Printing machines area	**302 s**	**123 s**
Cutting machines area	**141 s**	**64 s**

Table 3. Economic and financial viability.

ECONOMIC AND FINANCIAL VIABILITY		
	Number of Employees	**Costs of labor(US$)**
Initial direct labor	**20**	**15653,06**
Final direct labor	**14**	**10957,14**
Reduction cost/month		**4695,92**
Value of investments(US$)		
New equipment		**35.000,00**
Training		**3.000**
Total		**38.000,00**
Time for return on investment (Month)		**8,1**

Conclusions

From the results presented by the project, one can conclude that:
1) Lean manufacturing is distinguished for its efficiency in eliminating process waste, allowing the company to produce more with less resources. This was demonstrated in this study by:

- Reduced waste in transport by decreasing the flow of vehicles; Reduced time spent weighing the vehicles by modifying the weighing process;
- Reduced time looking for tools by workers, and an improved work environment, with the implementation of the "5S" program;

2) Even though the implemented proposal, based on the concepts of lean manufacturing, was simple and involved little financial resources, its results were highly effective, with a productivity gain of 30% and a return on investment in less than one year. This is the key point of the lean philosophy, i.e., "with little investment and a change in team behavior, to produce more, using less resources."

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References

Henderson, B. A., Larco, L. 2000. *Lean Transformation: How to change your business into a lean enterprise.* The Oaklea Press. Richmond, Virginia.

Lean Enterprise Institute. Available at http://www.lean.org.(accessed February, 15, 2013)

Nahmias, S. 2009. *Production and operations analysis.* Six Edition. McGraw-Hill International.

Sipper, D., Bulfin Jr., R. L.(1997) *Production, planning, control and integration*. The McGran-Hill International.